DEPARTMENT OF THE INTERIOR

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS BRANCH

1911 - 1912

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1913

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REPORT

OF THE

SURVEYOR GENERAL OF DOMINION LANDS

1911-1912

DEPARTMENT OF THE INTERIOR,
TOPOGRAPHICAL SURVEYS BRANCH,
OTTAWA, August 14, 1912.

The Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit the following report of the Topographical Surveys Branch for the year ended March 31, 1912.

Surveys were continued throughout the year in the western provinces, and subdivision was extended northerly into the Peace River block. Seventy-six parties were employed but only seventy-three of these worked the whole season, three parties being engaged for a short time only. The surveyors working under contract numbered thirty-four and were engaged on subdivision and timber berth surveys while the forty-two employed by the day were engaged on subdivision, resurvey and miscellaneous work of various kinds.

The spring and early summer of 1911 was abnormally wet and was the cause of much delay as surveyors had much difficulty in reaching the scene of operations. The surveyors report that the continued wet weather affected the proper ripening of the grain and that some low grade wheat was produced by being cut before it was properly ripened in order to escape frost.

The following statement shows the average number of miles of survey for each party during the last four years:—

1908	366 miles.
1909	412 "
1910	279 "
1911	280 "

One hundred and sixty-six whole townships and eight fractional townships were completely subdivided while a partial subdivision was made of three hundred and thirty others, and a resurvey either partial or complete was made of two hundred and twenty-five others.

The distribution of these parties by provinces is shown in the following table:—

Parties.	In Manitoba.	In Saskatchewan.	In Alberta.	In British Columbia.	Partly in one province and partly in another.	Total.
Paid by the day	3	3	12	6	15	39
Under contract	3	16	13	—	2	34
Parties engaged for a short time only	1	—	—	1	1	3
Totals	7	19	25	7	18	76

SURVEY OF BLOCK OUTLINES.

Seven surveyors were employed in running base lines and initial meridians in Manitoba, Saskatchewan and Alberta while three others were similarly employed in the Peace River block.

Mr. T. H. Plunkett, D.L.S., completed the survey, levels and building of mounds along portions of the fifth meridian and the twenty-eighth and twenty-ninth base lines west of the fifth meridian. These lines were run in 1910 by Mr. A. W. Ponton, D.L.S., but the ground was so wet that mounds could not be built. Mr. Plunkett reports last season's rains as being the heaviest in twenty years, but he succeeded in getting the low-lying portions of the lines mounded before the heavy rains set in.

The twenty-second base line was run west from the fifth meridian one hundred and twenty miles by Mr. A. H. Hawkins, D.L.S. He lost twenty days through wet weather and reports rain on ninety days out of one hundred and fifty-eight. The base line runs through fairly level country which has been overrun by fire and could be cultivated without very much expense in clearing. No hills over one hundred feet high were encountered on the line.

Mr. G. H. Blanchet, D.L.S., ran the twenty-third base line from the fourth to the fifth meridian. Upon the completion of this work he moved directly to the nineteenth base line between the same meridians and began the production of this line west from range 5.

Latitude observations were taken on the principal meridian and on the fourth meridian by Mr. J. A. Fletcher, D.L.S. The correct survey of the initial meridians is of the utmost importance as it is from these the base lines, which govern the township subdivision, are run. The southern portions of the meridians were run a number of years ago when the degree of accuracy under which work at the present time is done, could not be obtained by surveyors with the equipment at their disposal. Latitude observations were, therefore, necessary to detect and correct errors which might have occurred in the original surveys. Observations were taken at two places on the principal meridian, on the north shore of lake Winnipeg in township 48 and on the south shore in township 35. On the fourth meridian observations were also taken at two places in township 89 at the crossing of Clearwater river and in township 62 on the south shore of Cold lake.

Part of the seventeenth base line west of the third meridian was run by Mr. A. Saint Cyr, D.L.S. He also made a restoration survey of part of the fourth meridian south to the sixteenth base as the end of the seventeenth base fell in Cold lake and closing had to be effected on the adjoining base line. The country crossed by the seventeenth base line is fairly well wooded east of the crossing of Beaver river, but west from the river it is low and swampy.

Mr. E. W. Robinson, D.L.S., surveyed a portion of the second meridian and ran a portion of the fifteenth base line westerly therefrom. Along the second meridian the land is low and swampy while muskegs are numerous. They have, however, a hardpan bottom and none of them are of the floating variety. Although the temperature was at 80° Fahr. frost was encountered when digging the pits as the dry mossy surface absorbs the heat and acts as a very efficient non-conductor. With cultivation and drainage, however, this disadvantage will doubtless disappear.

Mr. A. W. Ponton, D.L.S., surveyed the principal meridian from the thirteenth to the sixteenth base line. He reports the country through which the line runs to be low, wet and swampy, with occasional outcroppings of rock. The surface, though mostly covered with trees of small dimensions is composed of black vegetable muck unsuited to agriculture.

Portions of the fourth meridian and of the twenty-fourth base line westerly therefrom were run by Mr. J. B. McFarlane, D.L.S. The fourth meridian was produced north to township 103. From township 95 north the soil is nine-tenths sandy with

jackpine and small muskegs. Fires sweep over this district about once every decade as the muskegs are not large enough to stop them. The country is not adapted to agriculture on account of the sandy nature of the soil, and rain, though fairly plentiful, falls generally in small drizzly showers.

SURVEYS IN THE PEACE RIVER BLOCK.

The Peace River block is a rectangular tract of land containing 3,500,000 acres. It is situated in British Columbia adjoining the Province of Alberta and was granted to the Dominion by the Province of British Columbia in exchange for land in the railway belt which had been disposed of by the province before the belt was placed under Dominion control. It was selected after an exploration by Messrs. J. A. Macdonell and J. A. Belleau in 1905-06, but the outlines had never been run to define its exact location. The survey of these outlines was a somewhat difficult undertaking.

During the past season four surveyors, Messrs. J. R. Akins, D.L.S., Geo. McMillan, D.L.S., O. Rolfson, D.L.S., and L. Brenot, D.L.S., were employed in outlining the block and running base lines across it.

Mr. Akins ran the north boundary and assisted Mr. Brenot to complete the west boundary. He experienced great difficulties in transportation as the snow was deep till late in the spring. Unless a surveyor is on the ground early he cannot accomplish much work, the summer season being short in these high latitudes.

Mr. McMillan ran the twenty-first base west across the block. He was assisted on the western portion by Mr. Brenot and on reaching the western boundary Mr McMillan ran the portion south to the southwest corner of the block while Mr. Brenot ran the portion north. Mr. McMillan had set out for the survey of the base line as early as February and he experienced some very cold weather, the thermometer registering as low as $-55°$ Fahr. but towards the end of March the weather moderated sufficiently to allow of the commencement of operations.

Mr. Rolfson ran the twenty-second base line across the block. He also experienced much difficulty in the transportation of supplies as the ice on Peace river west of Dunvegan was not strong enough to carry freighters ov'ing to the swift current in the river. The country crossed by the base line is fairly well woooded although there are occasional open patches of scrubby prairie.

A report on the surveys in the Peace River district containing a description of the country, surveyors' reports on townships and general information has been published in pamphlet form.

INSPECTION OF CONTRACT SURVEYS.

Surveys which are executed under contract must pass a rigid examination before being accepted. Five inspection parties under Messrs. P. R. A. Belanger, D.L.S., C. F. Miles, D.L.S., E. W. Hubbell, D.L.S., L. E. Fontaine, D.L.S., and G. J. Lonergan, D.L.S., were employed on inspection work during the past season. They also performed small miscellaneous surveys which happened to be in the vicinity of their work. It may be worthy of note that it was necessary to send an inspector into the Peace River district for the first time, to examine contract surveys. This shows at what a rapid rate settlement is advancing. Some of the townships inspected lie over 300 miles from the nearest railway.

Mr. Belanger inspected contract surveys in Manitoba and made some subdivision and traverse surveys at Pointe du Bois on Winnipeg river. He also surveyed a small settlement at Fisher Bay, the lots of which are all occupied by half-breed fishermen.

The inspection of contracts in Saskatchewan was done by Messrs. Miles and Hubbell, in the northwestern and north central portions respectively. Mr. Miles also made several miscellaneous surveys in the vicinity of his inspection work and subdivided a portion of the Cold Lake Indian reserve which was transferred to this Department by the Department of Indian Affairs.

Messrs. Fontaine and Lonergan were empl yed on inspection work in western and northwestern Alberta respectively. Mr. Lonergan's work extended into the Peace River district as twenty-eight townships were subdivided there under contract last year.

BRITISH COLUMBIA SURVEYS.

Surveys in the railway belt were continued under Messrs. W. J. Deans, D.L.S., J. E. Ross, D.L.S., C. H. Taggart, D.L.S., A. Lighthall, D.L.S., and A. V. Chase, D.L.S.

Mr. Deans completed several miscellaneous surveys and traverses; he also surveyed a number of timber berths north of Vancouver.

Mr. Ross subdivided land in the district south of Kamloops, while Mr. Taggart was employed on miscellaneous surveys north of Kamloops.

Mr. Lighthall did some levelling at Woodhaven on Bedwell bay in order to determine if the slopes would permit of changing the courses of some of the roads. He was also engaged on subdivision survey, timber berth survey and delimitation of a portion of the railway belt.

The examination of vacant lands in the Kamloops district, for purposes of classification into fruit land, farming land, grazing land, timber land and worthless land was continued by Mr. Chase. He also performed some miscellaneous subdivision in the vicinity of Lytton.

TOWNSHIP SUBDIVISION SURVEYS.

Subdivision surveys which were carried on in five hundred and four townships were executed by surveyors working under contract and also by some surveyors working under daily pay in localities where contract rates would not apply.

Some miscellaneous subdivision at Le Pas in northern Manitoba was done by Mr. A. L. MacLennan, D.L.S. He also surveyed a booming site on Carrot river applied for by the Finger Lumber Co.

Messrs. W. A. Scott, D.L.S., and J. Francis, D.L.S., were engaged on miscellaneous subdivision and surveys of coal claims in southwestern Alberta.

Mr. C. M. Walker, D.L.S., made a survey of land required for power purposes on Elbow river and subdivided portions of townships in southwestern Alberta.

Subdivision of lands through which the Alberta Coal branch of the Grand Trunk Pacific railway runs and surveys of coal claims in the same vicinity were made by Mr. A. L. McNaughton, D.L.S.

CORRECTION, RESTORATION AND MISCELLANEOUS SURVEYS.

Mr. A. L. Cumming, D.L.S., retraced two townships in the Cypress hills in order to determine the true bearings of the lines and to renew the monuments, replacing the old wooden posts by iron posts. He also made several small miscellaneous surveys in southern Alberta.

Mr. P. B. Street, D.L.S., subdivided some lands in the foot-hills of the Rocky mountains in southwestern Alberta in order to enable the Department to dispose of some coal lands and mineral claims near Pincher Creek. He also made several miscellaneous surveys in this vicinity and traversed a portion of Icelandic river in eastern Manitoba.

A correction survey of several townships in central Alberta was done by Mr. H. Matheson, D.L.S. These townships were partly subdivided under contract in 1908, and owing to difficulties in securing supplies the contractor did not complete the subdivision. Although the contractor was requested to return and finish the work, it was never satisfactorily done and Mr. Matheson was instructed to complete it.

Mr. C. F. Aylsworth made a subdivision into lots of the land around Max lake in Turtle Mountain forest reserve and Fish lake in Moose Mountain forest reserve for summer resort purposes.

Mr. C. Rinfret, D.L.S., destroyed duplicate monuments in a number of townships subdivided in 1883 in the vicinity of Moosejaw. He also resurveyed some townships near Maple Creek and towards the close of the season performed a number of miscellaneous scattered surveys.

Messrs. G. A. Bennett, D.L.S., E. S. Martindale, D.L.S., and R. C. Purser, D.L.S., were engaged on miscellaneous scattered resurveys, correction surveys, traverses and investigation of reported errors in Manitoba, Saskatchewan and Alberta.

Settlement surveys were made by Mr. H. S. Day, D.L.S., along the Athabaska at Pelican, Grand Rapids, McMurray, McKay and Chipewyan.

Mr. P. A. Carson, D.L.S., made a stadia traverse of a portion of North Lillooet river.

Mr. A. W. Ashton, D.L.S., surveyed a cemetery site near Blairmore and also performed some miscellaneous surveys near Lytton.

An investigation of old surveys near Deloraine which was urgently required was made by Mr. T. S. Nash, D.L.S., of the office staff.

Messrs. W. T. Thompson, D.L.S., and H. K. Moberly, D.L.S., were employed on the survey of timber berths.

The easterly portion of the triangulation survey in the railway belt was retraced by Mr. M. P. Bridgland, D.L.S. He renewed the monument at station I on the fifth meridian, erected by Mr. W. S. Drewry, D.L.S., in 1890, and re-established all the stations westerly to the summit of the Rockies. He also connected the triangulation with the monuments of the Dominion Lands system, wherever possible, and, although he failed to locate the monuments on the sixth meridian, as they had been destroyed by fire and lumbering operations, he found the nearest existing monument two miles farther west and tied it to the triangulation. A thoroughly reliable tie has thus been established by means of the triangulation between the fifth and sixth meridians. Mr. Bridgland also investigated surveys west of Calgary.

Mr. J. N. Wallace, D.L.S., who is in charge of levelling operations ran lines northerly from Prince Albert and Lloydminster. This survey was necessary to connect the levels already taken along the third and fourth meridians and adjoining base lines with the elevations along the railway which are at present the only available source of information in the western provinces regarding sea-level. The line of levels run northerly from Prince Albert is thirty miles while that northerly from Lloydminster is eighty-three miles.

YUKON SURVEYS.

Mr. F. H. Kitto, D.L.S., a member of the Topographical Surveys staff at Ottawa, was sent to Dawson to take charge of the survey office of the Yukon Territory upon the resignation of the former director.

Under the direction of the Commissioner of the Yukon Territory, Mr. Kitto undertook the reorganization of that office, in addition to the routine work which consists of giving information to the public, making blue-prints, tracings and sketches, mounting maps, writing descriptions, correspondence, examining and filing of plans and field notes.

At the request of the Commissioner, group lots and placer claims were surveyed by Mr. Kitto, and the revenue derived therefrom was transferred to the revenue of the Yukon Territory.

Alterations were made in the layout of the office and the lighting overhauled and improved.

In addition to the routine and reorganization work of the office, Mr. Kitto carried on a triangulation survey from Dawson up Klondike river about thirty miles. He also spent eighteen days in the field looking up various locations of trails, base lines and lot posts, for the information of the Territorial and Gold Offices.

Mr. H. G. Dickson, D.L.S., completed his survey under contract of the Carmack's reference traverse from the Nordenskiold valley to Jarvis creek in the Kluane District.

The staff of the Dawson office consists of three draughtsmen.

PHOTO-TOPOGRAPHIC SURVEYS.

Mr. Arthur O. Wheeler, who was formerly topographer on the surveys staff and is now director of the Alpine Club of Canada, made a photo-topographic survey of Mount Robson and the mountains of the continental divide north of the Yellowhead pass on the Grand Trunk Pacific railway. This survey was undertaken for the Grand Trunk Pacific Railway Co., the British Columbia and Alberta Governments and the Alpine Club. Mr. Wheeler offered to place the results of the survey at the disposal of the Department of the Interior provided the Department would assist by the loan of surveying instruments, by furnishing, developing and printing the photographic plates and by preparing the map for photo-lithography. The map, which contains much valuable information, obtained at a trifling cost, on a region hitherto unexplored, accompanies this report.

STATEMENT OF MILEAGE SURVEYED.

The following is a comparison of the mileage surveyed each year since 1909:—

Nature of Survey.	April 1, 1909, to March 31, 1910.	April 1, 1910, to March 31, 1911.	April 1, 1911, to March 31, 1912.
	Miles.	Miles.	Miles.
Township outlines	2,089	2,376	2,041
Section lines	16,326	11,849	10,098
Traverse	2,413	2,758	2,577
Resurvey	3,876	906	2,317
Total for season	24,704	17,889	17,033
Number of parties	60	64	61
Average miles per party	412	279	280

The following tables show the mileage surveyed by the parties under daily pay and by the parties under contract:—

SESSIONAL PAPER No. 25b

WORK OF PARTIES UNDER DAILY PAY.

Nature of Survey.	April 1, 1909, to March 31, 1910.	April 1, 1910, to March 31, 1911.	April 1, 1911, to March 31, 1912.
	Miles.	Miles.	Miles.
Township outlines	861	1,178	992
Section lines	1,956	1,487	823
Traverse	1,324	462	498
Resurvey	3,918	835	2,237
Total for season	7,059	3,962	4,550
Number of parties	34	30	29
Average miles per party	208	132	157

WORK OF PARTIES UNDER CONTRACT.

Nature of Survey.	April 1, 1909, to March 31, 1910.	April 1, 1910, to March 31, 1911.	April 1, 1911, to March 31, 1912.
	Miles.	Miles.	Miles.
Township outlines	1,228	1,198	1,049
Section lines	15,260	10,362	9,275
Traverse	1,089	2,296	2,079
Resurvey	68	71	80
Total for season	17,645	13,927	12,483
Number of parties	26	34	32
Average miles per party	679	410	390

Owing to the nature of their work, fifteen parties are not included in the statement of mileage for the year ended March 31, 1912.

COST OF SURVEYS.

The following statement shows the average cost per mile of surveys executed by surveyors under daily pay and by surveyors under contract:—

	Surveyed under daily pay.	Surveyed under contract.
Total mileage surveyed	4,560	12,483
Total cost	$380,943	$334,304
Average cost per mile	$83.72	$26.78

RECIPROCITY AMONG SURVEYORS.

As the outcome of a conference of surveyors held in Melbourne in 1892, the examination of land surveyors in New Zealand and in the several States of Australia is conducted by a common examining board and the surveyors who are admitted have the right to practise their profession in all parts of Australia and New Zealand.

In 1906, a formal invitation was received from the New Zealand Institute of Surveyors to join in this arrangement on behalf of Canada. Some correspondence was also exchanged with the Surveyor General of New Zealand on the same subject. It was explained to them that the surveyors of each Canadian province had formed associations which were incorporated by the provincial legislatures, and that there was no reciprocity among these different bodies. There was little prospect of joining Australia and New Zealand in reciprocal arrangements before such arrangements were made between the several Canadian associations.

At the Colonial conference of 1907, a motion was submitted by the Governor of New Zealand for establishing reciprocity among land surveyors throughout the Empire. The motion was discussed and adopted after amendment. It states that it is desirable that reciprocity should be established and commends it to the favourable consideration of the several governments.

In order to be admitted as a Dominion Land Surveyor, it is necessary to pass a preliminary examination for admission as a pupil. After three years' service, the pupil is entitled to present himself for final examination for a commission as a Dominion Land Surveyor. At the time of the Colonial Conference (1907), the law authorized a land surveyor licensed in any part of the Empire to present himself for final examination as a Dominion Land Surveyor after one year's service, without having to pass the preliminary examination.

In 1908, the Dominion Lands Surveys Act was passed by Parliament. Advantage was taken of the occasion to introduce an amendment with a view to giving effect to the desire expressed by the Colonial Conference if satisfactory arrangements could be made. The amendment authorized the Board of Examiners if they considered it advisable to do so, to dispense with the final examination of land surveyors from any particular part of the Empire. This amendment was strongly objected to in the Senate on behalf of the Ontario and Quebec land surveyors. Not only was the amendment withdrawn, but the whole section was struck out. Land surveyors from elsewhere than Canada have no longer any special privileges under the present law.

Representations against the new law were made by the Surveyors' Institution of Great Britain, who brought the matter to the attention of the Colonial Office. At their instance, His Majesty's Government invited the Dominion, Commonwealth, State and Provincial Governments to a conference of the Surveyors General of the Colonies, to be held in London on October 24, 1910. The invitation was accepted by the Dominion Government, but declined by all the Provincial Governments in Canada. It was also declined by Newfoundland and by the Union of South Africa. The Commonwealth of Australia, the Australian States and New Zealand asked a postponement of the date of the conference, which was accordingly fixed for the 30th May, 1911.

The delegates at the conference were:—Right Hon. Sir George Reid, P.C., G.C.M.G., K.C., High Commissioner for Australia, representing the Commonwealth; A. A. Spowers, Surveyor General of Queensland, and E. A Counsel, Surveyor General of Tasmania, representing New Zealand and the Australian States, with the exception of South Australia; E. Deville, LL.D., representing the Dominion of Canada; Col. S. C. N. Grant, C.B., C.M.G., R.E., Director General of the Ordnance Survey, A. Siemens, President, and five other members of the Institution of Civil Engineers; W. Edgar Horne, M.P., President, and five other members of the Surveyors' Institution.

The proceedings were opened by Lord Lucas, Under Secretary of State for the Colonies. Colonel Sir Duncan Johnston, K.C.M.G., C.B.R.E., late Director General of the Ordnance Survey, was elected chairman, and Mr. A. Goddard, secretary to the Surveyors' Institution, undertook the duties of secretary.

In order that the position of Canada should not be misunderstood, the Surveyor General of Dominion Lands at the first meeting submitted the following statement:—

When the Canadian Confederation was formed, in 1867, there were two Licensing Boards for Land Surveyors: one in Toronto, for the Province of Ontario, and one in Quebec, for the Province of Quebec. The requirements of the two Boards were very much alike, *viz.*, a preliminary examination, three years' service as a pupil under articles, and a final examination. By the British North America Act, property and civil rights had been placed under the control of the Provinces: no one was allowed to make land surveys unless he was a Provincial Land Surveyor.

At that time, the North West Territories were bought by the Dominion Government from the Hudson's Bay Company. These lands being the property of the Dominion and outside of the Provinces, were not under Provincial control, but Provincial Land Surveyors were at first employed for their subdivision because no others were available. In 1872, the need of better control over the surveyors of Dominion lands led to legislation creating Dominion Land Surveyors and a Board of Examiners for their admission. All Provincial Land Surveyors in 1872 were made Dominion Land Surveyors by the new Act. For some years there was reciprocity between the three Boards, but as each one was acting independently, grave abuses arose, and the arrangement was discontinued.

Meanwhile, the Province of Manitoba had been formed out of a part of the Northwest Territories. The Ontario and Quebec Land Surveyors had each the exclusive right to make land surveys within their own Provinces; likewise the Dominion Land Surveyors had similar rights within Manitoba and the Northwest Territories. The other Provinces had no licensed surveyors and the practice of the profession was free.

After 1883, there was a period of dullness in the land business of Manitoba. In order to improve their prospects, the Dominion Land Surveyors of Manitoba formed an association, were incorporated by their legislature as Provincial Land Surveyors, and given the exclusive right to make land surveys within the Province. This was later resented by the Dominion Land Surveyors of the adjoining Territories, who were turned away at the boundaries of Manitoba, while those Manitoba Land Surveyors, who were also Dominion Land Surveyors, could freely practise within the Territories. As soon as the Provinces of Saskatchewan and Alberta were formed, their Dominion Land Surveyors retaliated by obtaining drastic legislation incorporating Land Surveyors Associations in each Province and excluding all other surveyors. This legislation practically abolished Dominion Land Surveyors as a profession, these two Provinces being the last ones where they could practice land surveying. At present, they can only act as employees of the Dominion Government. It follows that although the Surveyor General of Canada is a delegate to the Conference, he does not actually represent any branch of the surveying profession of Canada.

The first proposal of reciprocity was made to Canada at the time of the negotiations between New Zealand and Australia, by Mr. Marchand, then Surveyor General of New Zealand. The Surveyor General of Canada replied that personally he was in favour of the proposal, but it was not until 1908 that an opportunity was found of giving effect to this suggestion. In that year the law respecting Dominion Land Surveyors was recast, and an amendment was introduced authorizing the Board of Examiners to enter into reciprocal arrangements with other parts of the Empire. This amendment was strongly objected to by the Ontario and Quebec surveyors: the opposition in Parliament was such that the Government withdrew not only the proposed amendment but also a previously existing clause granting certain privileges to surveyors from other parts of the Empire. In view of the strong objections of the Canadian

Surveyors to any proposals of reciprocity, and of the fact that it does not even exist amongst themselves, it seems that there is little prospect of the immediate adoption by them of the wider scheme of reciprocity throughout the Empire.

While recognizing the difficulties which stood in the way, the consensus of opinion among the delegates was that they had been called together for the purpose of preparing a scheme of reciprocity and that it was their duty to prepare such a scheme. The recommendations agreed upon contemplate uniform examinations, the syllabus of which was drafted by the Conference, similar terms of service everywhere and the creation of a Central Board to hear appeals against any of the local examining authorities. The Conference's report concludes as follows:

The free discussion which has taken place at the Conference does not permit the delegates to overlook the difficulties which undoubtedly exist in the way of a general agreement for reciprocity; and although they are conscious that the scheme they have formulated will not provide a complete answer to every objection which can be raised, they venture to submit it as offering a groundwork for a future agreement among the Dominion, Provinces or States who desire to enter into reciprocal arrangements.

Should any Government not find it practicable to accept in its entirety the scheme herein submitted, it may be that they will be able to adopt such parts of it as their circumstances permit. Even if a part only of the examinations for qualifying as surveyors should be accepted throughout the Empire, so that a candidate who had passed that part of the examination in any portion of the Empire would be excused having to undergo it again, in order to qualify as a surveyor in another portion of the Empire, a step forward would be made. In particular, the delegates wish to emphasize the importance they attach to the formation of the Central Board.

CORRESPONDENCE.

The correspondence of this Branch consisted of:—

Letters received	11,675
Letters sent	16,120

ACCOUNTS.

Number of accounts dealt with	1,024
Amount of accounts	$943,386
Number of cheques forwarded	3,068

OFFICE STAFF.

The office staff of the Topographical Surveys Branch at Ottawa consists of one hundred and twenty-seven employees, being an increase of one over the staff of last year.

Fifteen appointments were made, one employe was superannuated, nine resigned, while four were transferred to other Branches of the Department.

The appointments were:—Messrs. W. B. Armstrong, J. E. Spero, L. A. Nevins, J. F. McDonald, A. S. Thomas, H. C. Smith, G. N. Clarke, A. G. McLennan, G. H. Watt, G. A. Colquhoun, J. J. Freeland, W. H. Herbert, H. Parry, R. C. Ross and L. G. Smith. Mr. P. B. Symes was superannuated, Messrs. J. E. Umbach, R. C. McCully, C. P. Dubuc, C. M. Ross, A. H. Beaubien, H. Osmond, C. M. Hoar, J. Fredette and B. J. Roe resigned, while Mr. J. A. Belleau was transferred to the Lands Patents Branch, Mr. A. M. Grant to the Chief Astronomer's Branch, Mr. A. Tremblay to the Railway Lands Branch, and Mr. C. E. Marchand to the Geographer's Branch.

Mr. Symes, Chief Draughtsman, who, on account of continued ill-health, was superannuated after more than forty years of service, was connected with the Branch since its inception in 1875. He was a very valuable officer and had an intimate knowledge of the work, having materially assisted in the growth of the Branch from a small office in the Department of the Secretary of State to its present large dimensions. His unfailing courtesy and patience in his relations with the staff made his retirement a matter of general regret. The position of Chief Draughtsman, rendered vacant by his superannuation, was filled by the promotion of Mr. T. Shanks, B.A. Sc., D.L.S., formerly Assistant Chief Draughtsman. Mr. T. E. Brown, B.A., has been appointed to this latter position and the place formerly held by him, that of chief of the first section, was filled by the promotion of Mr. H. G. Barber.

CHIEF DRAUGHTSMAN'S OFFICE.

(T. Shanks, Chief Draughtsman.)

The progress of our work during the past year was seriously retarded by changes in the personnel and organization of the staff owing to transfers, resignations and absence from various causes.

There is possibly no other Branch in the Service which has suffered more than ours in the last few years from transfers and resignations. During the past year fourteen clerks left the office and the strength of the technical portion of the staff is no greater now than at the time of the reorganization in 1908, although the work has greatly increased. The activity in general engineering work throughout the Dominion has made it difficult to secure or retain properly qualified men and the salaries offered in this Branch of the Service are not sufficiently attractive to offset the advantages of a less restricted career outside where there are brighter prospects for more rapid promotion, greater variety of work and higher remuneration. The reorganization of 1908 and the consequent transfer of many temporary employes to the permanent staff has undoubtedly helped to make the tenure of office more continuous than before, but conditions are not likely to be satisfactory until provision is made for better salaries for technical men and improved facilities for more rapid promotion.

Attention has been repeatedly called to the serious handicap to efficient organization and the prompt dispatch of business owing to the fact that our staff cannot be accommodated in one building or in offices convenient to the other Branches of the Department. The nature of our work necessitates frequent reference to the records of old surveys and as these are stored in a separate building the work is subject to awkward interruptions and delays. Moreover, it frequently happens that many of the record books and plans are retained in our offices for long periods, and with no adequate protection from fire. These valuable records comprise a complete history of Dominion land surveys, and as their loss would be irreparable provision should be made as soon as possible for their safe-keeping.

The average number of surveyors employed in the field each year for the past ten years has been sixty-four, about equally divided between contractors and day men. The present tendency is towards an increase in the number of day men, and a corresponding falling off in contract work. One chief cause of this is the fact that as the country becomes settled the amount of work affecting old surveys increases. Errors come to light, monuments disappear, topographical features change, modifications of the old surveys are rendered necessary and the resurveys which result are too complicated to be done under contract. This change brings with it an increase in office work, as instructions to surveyors must be prepared in greater detail than for regular township subdivision, the examination of survey returns is more laborious and the preparation of the more involved plans requires greater skill in draughtsmanship than

for the ordinary township plans, where much of the draughting and printing are done by mechanical means. The demand for original subdivision is still great, however, and it is estimated that about 180 townships will be surveyed under contract during 1912.

The primary object of our field work is to delimit the land for purposes of disposal and the plans of these surveys which are most urgently needed are those upon which entries may be granted and patents issued. But in addition to the work of marking out the boundaries of sections the surveyor collects much valuable information as to the character of the soil, the topography of the country, the extent of timber and prairie land and the natural resources of the district. An attempt has been made to compile this information in convenient form for reference but little progress has been made owing to the press of urgent routine work. Unless this information is up to date it loses much of its value and it is desirable that some arrangement shall be made to ensure early publication of data which, if one may judge from the inquiries received, are of great interest to the public.

FIRST SECTION—SURVEY INSTRUCTIONS AND GENERAL INFORMATION.

(H. G. Barber, Chief of Section.)

In this section instructions are prepared for surveyors engaged in field operations, and the returns of survey sent in by them are entered in the office registers. Preliminary plans are issued for all townships in which subdivision is done, except in the railway belt of British Columbia. This section also has charge of the preparation and issuing of the annual report of the Branch, and the answering of all requests for information from the general public or from other Branches of the Department.

During the year 161 drafts of instructions were issued involving the preparation of 1,905 sketches and 46 maps and tracings. These contained all necessary information regarding Dominion lands, Indian reserves and other surveys already made in the vicinity, as well as all available information as to the nature of the country, roads, trails and methods of transportation.

Preliminary plans were issued for 285 townships. Four copies of each are prepared, one copy being placed on file in this office, and one each being furnished to the Survey Records Branch, the Lands Patents Branch and the Land Agent in whose district the township lies.

The number of files received from the Correspondence Branch for use in the work of the office was 1,800, and the total number of draft letters and memoranda written was 4,930.

The Manual of Instructions for the Survey of Dominion Lands was again revised. It is now almost ready for printing and will be issued in the course of the coming year.

During the year a report on the Peace River district was prepared and issued for the information of intending settlers. It gives a description of the soil, climate and main topographical features and of the various roads and trails leading into the country, with information about the stopping-places, best means of transportation, etc. A map of the district accompanies the report.

Answering communications from settlers and others on various subjects and inquiries from other Branches of the Department forms an important part of the work. The number of communications dealt with during the year was 1,883, requiring the preparation of 3,599 sketches, 34 plans and tracings and 343 pages of field notes.

The office registers show that 1,142 progress sketches were received from the surveyors in the field, as well as 364 books of field notes for township surveys, 188 books and 330 plans for miscellaneous surveys, 235 timber reports, 86 statutory declarations of settlers and returns for 746 magnetic observations and for 29 timber berths. General reports on survey operations were received from thirty-eight surveyors.

Their examination being completed, 395 books of field notes of township surveys were placed on record together with 89 books and 137 plans of miscellaneous surveys and 86 statutory declarations of settlers.

Plans of 797 townships and 11 settlements or townsites were received from the lithographic office, entered in the registers and distributed, as well as 73 sectional maps and 106 miscellaneous plans.

The staff of this section consists of twenty-one permanent and three temporary employees, but of this number one is engaged the whole time in looking after the vault where numerous valuable records and sectional maps are kept, and the services of another employee are required to attend to requisitions for supplies for the whole Branch and the stationery for the office staff and the staff of surveyors in the field.

SECOND SECTION—EXAMINATION OF RETURNS OF SURVEYS IN MANITOBA, SASKATCHEWAN, ALBERTA AND YUKON TERRITORY.

(T. S. Nash, Chief of Section.)

The work performed in the second section consists of the examination of the returns of survey of all Dominion lands other than those in the railway belt in British Columbia, and the preparation of the required plans thereof.

As soon as a surveyor completes the survey of a township, or a portion thereof, he forwards a sketch showing the progress of the work in the field. These sketches are examined to see that correct methods are being employed and that accurate results are being obtained. They also form the basis for advances to contractors on progress accounts.

During the year 335 progress sketches from contractors, 440 from men employed by the day and 196 from inspectors of contract surveys were examined, making a total of 971 sketches. Plans of 348 townships were compiled, 209 of which were first edition plans. The total number of township plans compiled is much smaller than in previous years, as the practice of compiling reprints of old surveys where the stock of township plans is exhausted, was discontinued.

An examination was made of 224 subdivision surveys and 186 miscellaneous surveys. Compiled plans of 16 miscellaneous surveys and 24 timber berths were made. Four hundred and nineteen memoranda on the examination of survey returns were sent to surveyors and 355 replies were received and the necessary corrections made. The number of draft letters prepared was 1,350. Twenty-six contract accounts were prepared and closed as the work was shown by the inspector's report to be satisfactorily performed.

In the report of last year it was stated that the question of issuing maps of the surveys in the Yukon Territory would be taken up this year. This has been done; a style of plan has finally been adopted and the first one, which covers the district in the immediate vicinity of Dawson, has been printed, while two others will be printed shortly. The new plan, which covers approximately sixteen miles in latitude and twenty miles in longitude is printed on a scale of one mile to the inch, and shows, in addition to surveys all available geographic information. A new filing cabinet for the Yukon work has been procured and a great number of plans have been thoroughly cross-indexed and filed for ready reference in compiling Yukon surveys. During the year 61 group lot surveys were examined. The remaining part of the Carmack's reference traverse and the returns of survey of the road from Yukon Crossing to Whitehorse were also received and examined.

Requests for information from other Branches of the Department involved the writing of 220 memoranda, the preparation of 126 sketches and the calculation of 1,635 areas.

Two hundred and ninety-three plans of road diversions and 26 of timber berths were examined. The timber berths comprised 68 blocks and their boundaries totalled 569 miles, while the area is approximately 276 square miles. Twenty-four plans for these berths were prepared.

One hundred and eighty plans of right-of-way of railways were examined, the mileage of which is 3,114. As many of these plans were in duplicate and triplicate the gross mileage of plans examined was 5,892.

A large amount of work has been put upon the preparation of a topographical map of the valley of Fiddle creek, a tributary of Athabaska river in the Jasper Forest Park reserve, and in assisting the surveyor to complete his final returns of this survey.

The staff consists of twenty-six permanent and two temporary employees, but one of the permanent clerks is at present in charge of the office at Dawson, Yukon Territory.

THIRD SECTION—PREPARATION OF PLANS FOR REPRODUCTION.

(C. Engler, Chief of Section.)

The work of the third section consists in the preparation of copies of plans (which have been compiled in the second, fourth and sixth sections) for reproduction by photo-zincography or photo-lithography.

The appearance and accuracy of the printed copies of the various plans which are issued depend largely on the care given to the production of the fair or finished copies prepared in this section.

The efforts of both draughtsmen and stampers are directed to producing plans on which the information is shown accurately to scale, well arranged and of clean and neat appearance.

The various processes used in preparing fair copy plans have been described in previous reports.

The bulk of the work done in this section has necessarily been in connection with the issuing of township plans. Other plans prepared have been required for showing timber berths, orders in council, settlements or townsites, Yukon Territory group lots, Doukhobor villages and plans for the annual report.

Besides these, there are a number of plans and jobs forming a miscellaneous class in connection with the requirements of the Branch, difficult to classify, but forming an important factor in work of the section.

A statement showing the classification and number of jobs undertaken and completed is given in the report of the Chief Draughtsman.

The staff numbers thirteen, three previous members having been transferred to other Departments or offices, and two appointments having been made.

In addition, the services of an assistant printer are constantly required and three temporary employees were appointed, one of whom has lately been transferred to another Department.

FOURTH SECTION—SURVEYS IN THE RAILWAY BELT, BRITISH COLUMBIA.

(E. L. Rowan-Legg, Chief of Section.)

Instructions were prepared for surveys to be made in the railway belt and were accompanied by sketches and any other information which it was considered would be of assistance to the surveyors.

The greater part of the subdivision surveys which had to be shown on the township plans compiled during the year were those in which monuments were erected, as far as practicable, at legal subdivision corners and in the centre of legal subdivision

boundaries along the surveyed lines, so that the lands might be disposed of in parcels of such sizes as may be desired.

On account, therefore, of the additional information required to be shown in connection with these surveys, quarter township plans were made on a scale of twenty chains to one inch. On these are shewn the position and nature of all monuments, the distances between them, the bearings of the section or quarter section boundaries, the area of each legal subdivision or quarter section where monuments were placed at quarter section corners only, the section and legal subdivision numbers and provincial lots, Indian reserves, mineral claims, lakes, rivers, creeks and trails.

Field notes of the surveys of mineral claims, of miscellaneous surveys and of timber berths were examined. Plans of timber berths were made, and fair copies of them were forwarded to the Timber Branch.

A plan of the townsite of Field, in section 17, township 28, range 18, west of the fifth meridian, was compiled and printed, and also a second edition of the plan of the town of Lytton in section 6, township 15, range 26 and section 1, township 15, range 27, west of the sixth meridian.

In 1909, Mr. A. W. Johnson made a subdivision survey of villa lots at Woodhaven, in sections 23, 24 and 25, fractional township west of township 39, west of the coast meridian on Bedwell bay, north arm of Burrard inlet, a plan of which was compiled and printed.

This year a plan showing the block outlines of a proposed additional subdivision at Woodhaven was made for the guidance of the surveyor when the survey is being made.

The staff consists of seven permanent clerks, which is two fewer than the staff of the previous year.

FIFTH SECTION—MAPPING

(J. Smith, Chief of Section.)

The principal work of this section is the revision of sectional maps that have already been printed, and the completion of new sheets as they are required. Appendix No. 6 of this report shows the work done in this section during the year on sectional maps.

In addition to these maps, the following drawings were made:—A manuscript chart of the magnetic declination covering the southern part of Canada and the northern part of the United States, drawn on two sheets on a scale of one hundred miles to one inch to be photo-engraved on copper and printed on a scale of three hundred miles to one inch; a map of the Peace River district and one of the Peace River block on a scale of four miles to one inch; a map showing the topography along the fifteenth base line in the vicinity of the second meridian, drawn on a scale of four miles to one inch, to be photo-zincographed on a scale of six miles to one inch; a tracing of part of the Selkirk range on a scale of $\frac{1}{40,000}$, to be photo-lithographed on a scale of $\frac{1}{80,000}$.

Thirteen permanent employees constitute the staff of this section.

SIXTH SECTION—SCIENTIFIC AND TOPOGRAPHICAL WORK

(G. Blanchard Dodge, Chief of Section.)

The work performed in general in this section consists of issuing instructions for and plotting returns of levels on meridians and base lines, checking and reducing magnetic observations, calculating astronomical field tables, testing and adjusting survey instruments, and preparing and issuing the pamphlets containing surveyors' township reports, &c.

The standard of accuracy of the levels on meridians and base lines was raised for 1911, and the difference of elevation between adjacent bench marks was required to be checked by a second independent line, the two lines to check between adjacent bench marks within 0.1 feet multiplied by the square root of the distance in miles.

All the level notes for 1910 have been checked, lists of bench marks prepared and profiles plotted. During the year 1,427 miles of level returns were received while 1,502 miles had been received previously. Level returns were examined and profiles plotted of 1,660 miles. All the lines on which levels have been run prior to March 31, 1912, are shown on a map which accompanies this report.

The number of magnetic declination returns received prior to March 31, 1912, was 2,841, of which 746 were received during the year. A statement of the results with a map showing the isogonic lines in that portion of western Canada covered by the Dominion Lands system of survey is published with this report.

The office computations of triangulation surveys in the railway belt, British Columbia, have been brought up to date, but further information is necessary before much use can be made of the present results. It is hoped that the returns for next season's surveys will supply this information.

All the returns of azimuth observations for the year 1910, received during 1911, have been examined and checked, and also the latitude observations of Mr. J. A. Fletcher, D.L.S., taken during 1911. The astronomical field tables for the year have been computed.

Compiling surveyors' reports on the townships subdivided requires the services of four of the staff. A report on the townships covered by the Fort Pitt sectional sheet has been compiled and sent to the printers for publication.

Information was obtained for a map to accompany the report of 'Descriptions of Surveyed Townships in the Peace River district,' and a rough copy of the map was made with the information added.

A surveys laboratory for testing instruments has lately been built, and it has already proved very useful. Although only a portion of the equipment has been installed, facilities will be provided for testing and adjusting surveying transits, levels, aneroid barometers, measuring tapes, etc., and for rating chronometers and watches.

The number of letters received during the year was 446 while the number of letters sent was 1,130 besides 498 memoranda. Seventy-nine letters of instructions to surveyors were prepared.

The staff of the section consists of fourteen permanent clerks and two temporary clerks.

PHOTOGRAPHIC OFFICE.

(J. Woodruff, Chief Photographer.)

The offices of the Chief Photographer have been moved to the rooms in the basement formerly occupied by the lithographic office. The rooms have been fitted with the necessary appliances and afford every facility for the work.

There has not been much change in the amount of work executed. Velox and blue printing have increased but other lines have decreased.

The staff of four assistants is the same as last year.

PHOTOGRAPHIC OFFICE.

(H. K. Carruthers, Process Photographer.)

With the removal of the Chief Photographer's offices to the basement, it has been possible to give increased accomodation to the Process Photographer.

The four dark rooms were made into two rooms, thus providing ample space for handling large zinc plates and glass negatives.

Sectional maps on a scale of three miles to one inch which before required two 18-in. x 20-in. negatives are now made on one 21-in. x 32-in. plate and printed direct on zinc for the press.

Three township plans are printed at one operation on zinc 32-in. x 49-in. and sen direct to the lithographic office ready for the press.

A new automatic mercury vapour lamp was installed. Five tubes are used in connection with a pneumatic printing frame 36-in. x 60-in., an automatic electric pump maintaining the vacuum.

A full set of machines for line and half-tone engraving was set up in the basement of the Imperial building. Twenty-one half-tone engravings were made to illustrate the Peace River report and almost a full set of line cuts for the Manual of Survey.

The staff was increased by the appointment of Mr. Leonard G. Smith as assistant process photographer, and now consists of four men. Mr. Smith has attended for six years the London County Council School of Photography, Engraving and Lithographing, and was six years on the staff of the Geographical Section of the War Office. He has proved a valuable addition to our staff.

In order to answer numerous enquiries concerning our copying camera, a description of the camera has been published in pamphlet form. It is annexed to this report as Appendix No. 51.

LITHOGRAPHIC OFFICE.

(A. Moody, Foreman.)

The lithographic office has been removed to the Imperial building on Queen street where it occupies the whole of the basement. This place was probably the best available in town; it affords splendid accommodation and no better quarters could be had unless a building was erected for that special purpose. The only disadvantage is that the place is a little damp in summer; it causes some trouble in registering coloured impressions.

A power paper-cutter was added to the equipment which now consists of a flat-bed power-press, a rotary offset power-press, three hand-presses for transferring, a zinc-plate graining machine and a power paper-cutter.

The work is for the greater part photo-zincographic printing. A few maps are printed on stone; others are engraved and transferred.

The staff of ten employes is the same as last year.

GEOGRAPHIC BOARD.

(A. H. Whitcher, Secretary.)

The Geographic Board has held a number of meetings and gave decisions on the geographic names submitted. The Chairman is Col. W. P. Anderson, Chief Engineer of Marine and Fisheries, and the report of the Board is published by his Department.

The Secretary is a member of the staff of this office.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

(F. D. Henderson, Secretary.)

The Board of Examiners for Dominion Land Surveyors held a special meeting for the examination of candidates from April 29, 1911, to May 18, 1911, during which examinations were held at Ottawa, Toronto, Regina and Vancouver. An adjourned meeting for the preparation of examination papers was held from October 2 to October 12, 1911. The regular annual meeting began on February 12, 1912, and lasted until March 23, 1912. During this meeting examinations were held at Ottawa, Montreal, Kingston, Toronto, Winnipeg, Calgary and Edmonton.

The total number of candidates for examination during the year was 268, as against 257 in 1910-11, and 362 in 1909-10. Of these 186 tried the full preliminary, 9 the limited preliminary, 71 the final, and 2 the examination for Dominion Topographical Surveyor.

Fifty-seven candidates were successful at the preliminary examination as follows:—

PRELIMINARY EXAMINATION.

Atkins, Cecil Ben., Revelstoke, B.C.
Bedard, Edward L., Courtright, Ont.
Britton, George Clayton, Whitby, Ont.
Burland, George Lewis, Ottawa, Ont.
Burrell, Eric, Yarmouth North, N.S.
Byron, Malcolm Ross, Ottawa, Ont.
Cameron, Charles Scott, Regina, Sask.
Campbell, John James, Galt, Ont.
Carlile, Reginald Clifford, Calgary, Alta.
Carty, Edward Godfrey, Ottawa, Ont.
Cavell, Edward, Toronto, Ont.
Clarke, Roger Fyfe, Hamilton, Ont.
Clouston, Noel Stewart, Winnipeg, Man.
Coursier, Eric Clarence, Revelstoke, B.C.
de Noblens, Gerard, Aldersyde, Alta.
Duffield, Hugh J., Calgary, Alta.
Ells, Sidney C., Ottawa, Ont.
Falconer, Fairbairn S., Shelburne, Ont.
Finnie, Oswald Stirling, Ottawa, Ont.
Fournier, Ovide Edouard, Ottawa, Ont.
Fraser, Jonathan William, Ottawa, Ont.
Gardner, Charles Turville, Walhachin, B.C.
Gardner, James David, Ottawa, Ont.
Grange, Edward Rochfort, Toronto, Ont.
Hardouin, Joseph, Calgary, Alta.
Heinonen, Henry J., Toronto, Ont.
Jordan, Edward Elliot, Ottawa, Ont.
King, John Albert Shirley, Ottawa, Ont.
Le Blanc, Pierre Maxime Henri, Ottawa, Ont.
Lowrie, Arthur Wellington Percy, Russell, Ont.
Malcolm, William Noel, Winnipeg, Man.
Miller, Albert Sherman, Brighton, Ont.
Milliken, John Bolton, Ottawa, Ont.
Moran, Patrick Joseph, Kingston, Ont.
Murdie, William Campbell, Winthrop, Ont.
MacTavish, William Higgins, Van Camp, Ont.
McCaw, Donald Arthur, Welland, Ont.
McDonald, Roderick C., Ripley, Ont.
McFaul, W. Lawrence, Owen Sound, Ont.
Nesham, Lionel Charles, Ottawa, Ont.
Nicklin, Harold Raymond, Millbank, Ont.
Noecker, Claude, Waterloo, Ont.
Oke, William Verner, Toronto, Ont.
Platt, Errol Beauchamp, Toronto, Ont.
Rhys, Howard Leonard, Ottawa, Ont.
Robertson, John Donald, Edmonton, Alta.
Ross, Othmar Wallace, Brantford, Ont.
Somers, Newton Lloyd, Rockford, Ont.
Spence, William A., Ottawa, Ont.
Spero, John Ethelbert, Ottawa, Ont.
Stidwill, Frank, Cornwall, Ont.
Tye, Howard Warner, Stratford, Ont.
von Gunten, Carl Frederick, Blenheim, Ont.
Walker, George Stuart, Renfrew, Ont.
Watson, Angus Robert, Beaverton, Ont.
Wrong, Frederick Hay, Windsor, Ont.
Young, Stewart, Owen Sound, Ont.

Forty-eight candidates were successful at the final examination as follows:—

FINAL EXAMINATION.

Berry, Edward Wilson, Seaforth, Ont.
Boulton, William James, Wallaceburg, Ont.
Brown, Edgar Carl, Regina, Sask.
Burd, James Henry, Weyburn, Sask.
Cline, Carl Gordon, Toronto, Ont.
Cond, Fritz Thomas Piercy, Vancouver, B.C.
Cote, J. Aurele, Ottawa, Ont.
Dann, Eyre Morton, Kamloops, B.C.
Dennis, Thomas Clinton, Ottawa, Ont.
Earle, Wallace Sinclair, Victoria, B.C.
Fawcett, Sidney Dawson, Ottawa, Ont.
Fletcher, James Allan, Fletcher, Ont.
Fraser, Donald John, Ottawa, Ont.
Matheson, Hugh, Ottawa, Ont.
Melhuish, Paul, Vancouver, B.C.
Menzies, John Whyte, Ottawa, Ont.
MacKay, Ernest George, Hamilton, Ont.
MacLeod, George Waters, Edmonton, Alta
McColl, Samuel Ebenezer, Winnipeg, Man
McEwen, Duncan Findlay, Edmonton, Alta.
Narraway, Athos Maxwell, Ottawa, Ont.
Neelands, Rupert A., Hamiota, Man.
Neville, Everett A., Ruthven, Ont.
Palmer, Philip Ebenezer, Dorchester, N.B.
Peckover, Horace Joseph, Toronto, Ont.
Robinson, William Andrew, Winnipeg, Man

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Galletly, James Simpson, Brooklin, Ont.
Greene, Gerald Elliot Denbigh, Toronto, Ont.
Haggen, Rupert Williams, Revelstoke, B.C.
Hamilton, Charles Thomas, Vancouver, B.C.
Higgins, Connell J., Vancouver, B.C.
Hobbs, Wilfrid Ernest, Winnipeg, Man.
Hunter, A. Ernest, Wiarton, Ont.
Inkster, Oluff, Edmonton, Alta.
Jackson, John Edwin, Oxford Centre, Ont.
Jones, George Samuel, Ottawa, Ont.
Lindsay, James Herbert, Regina, Sask.
Loucks, Roy William Egbert, Saskatoon, Sask.
Roger, Alexander, Ottawa, Ont.
Stewart, Norman Charles, Nelson, B.C.
Stitt, Ormond Montgomery, Vancouver, B.C.
Stuart, Alexander Graham, Buckingham, Que.
Taggart, Charles Henry, Ottawa, Ont.
Tate, Harry William, Toronto, Ont.
Tipper, George Adrian, Brantford, Ont.
Tremblay, Albert Jacques, Edmonton, Alta.
Underwood, Joseph Edwin, Saskatoon, Sask.
Whyte, Harold Eustace, Victoria, B.C.
Wright, Alfred Esten, Prince Rupert, B.C.

As in former years, the time of the Board was largely taken up with the reading and valuation of the candidates' answers and with the preparation of sets of questions for the several examinations. The evidence as to the standing of final candidates, consisting of Provincial certificates in the case of Provincial Surveyors writing under section 21 of the Act, and of affidavits of service under articles in the case of others, had to be examined and passed upon.

The privilege of serving one year under articles instead of three years, as provided by Section 22 of the Act, was extended to graduates of the University of Liverpool holding the Degree of Bachelor of Engineering with Honours, and to graduates of the University of Dublin holding the Degree of B.A.I.

The forms of articles and of the transfer of articles (given in the Schedule of the Act as Forms B and D) are considered by the Board as unnecessarily long and involved. Considerable discussion took place with a view to preparing forms which would be shorter and easier to fill out.

When there are many candidates and when the examinations are held at places distant from Ottawa, it frequently happens that the results of the examinations are not known for a month or more after the candidates have finished writing. Thus the three weeks of grace allowed by the Rules of the Board is not enough to permit candidates who have passed the preliminary examination to come up for final examination one year or three years after as seems the intention of the Act. The Rules of the Board were, therefore, changed in this respect so as to allow any person who passes the preliminary examination and who becomes articled immediately on receiving notice thereof to write on the final examination in one year or in three years, as the case may be.

Oaths of office and allegiance and bonds for the sum of one thousand dollars each, as required by Section 25 of the Act, were received from, and commissions as Dominion Land Surveyors were issued to, fifty-one surveyors.

Subsidiary standards of length as required by Section 35 of the Act, were tested and issued to thirty-seven surveyors. One standard which had changed hands was retested. A list of surveyors who have been furnished with standard measures up to March 31, 1912, will be found in Appendix No. 10.

The correspondence of the Board was as follows:—

Letters received	1,824
Letters sent	880
Circular letters, pamphlets, and parcels sent	1,517

APPENDICES.

The following schedules and statements are appended:—

No. 1. Schedule of surveyors employed and work executed by them from April 1, 1911, to March 31, 1912.

No. 2. Schedule showing for each surveyor employed from April 1, 1911, to March 31, 1912, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey; also the cost of the same.

No. 3. List of lots in the Yukon Territory, surveys of which have been received from April 1, 1911, to March 31, 1912.

No. 4. List of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1911, to March 31, 1912.

No. 5. Statement of work executed in the office of the chief draughtsman.

No. 6. List of new editions of sectional maps issued from April 1, 1911, to March 31, 1912.

No. 7. Statement of work executed in the photographic office from April 1, 1911, to March 31, 1912.

No. 8. Statement of work executed in the lithographic office from April 1, 1911, to March 31, 1912.

No. 9. List of employees of the Topographical Surveys Branch at Ottawa, giving the name, classification, duties of office and salary of each.

No. 10. List of Dominion Land Surveyors who have been supplied with standard measures.

No. 11 to 49. Reports of Surveyors employed.

No. 50. The Determination of the Magnetic Declination Dip and Total Force in Western Canada.

No. 51. The Copying Camera.

MAPS AND PROFILES.

The following maps and profiles accompany the report of the Topographical Surveys Branch in monograph form:—

Map showing surveys to March 31, 1912.
Map of Mt. Robson and vicinity.
Maps to accompany reports of surveyors.
Profiles of meridians and base lines.

I have the honour to be, Sir,

Your obedient servant,

E. DEVILLE,
Surveyor General.

TOPOGRAPHICAL SURVEYS BRANCH

SCHEDULES AND STATEMENTS.

APPENDIX No. 1.

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912.

Surveyor.	Address.	Description of Work.
Akins, J. R.	Ottawa, Ont.	Survey of the north boundary of the Peace River block, production of the twenty-third base line across ranges 10, 11 and 12, and parts of ranges 9 and 13; survey of the east outlines of townships 85, 86, 87 and 88, range 13, west of the sixth meridian.
Allison, C. B.	South Woodslee, Ont.	Contract No. 4 of 1911. Subdivision of townships 36 and 37, range 20, townships 34, 35 and 36, range 21, the southerly two-thirds of township 38, range 20, and the northerly third of township 33, range 21, west of the principal meridian.
Ashton, A. W.	Ottawa, Ont.	Survey of Blairmore cemetery in township 8, range 4, west of the fifth meridian. Miscellaneous surveys in townships 20 and 21, range 24, and at Lytton in township 15, range 27, west of the sixth meridian.
Aylen, J.	North Bay, Ont.	Contract No. 7 of 1911. Subdivision of township 46 and the north third of township 45, range 9, townships 46, 47, the north third of township 45 and the south two-thirds of township 48, range 10; survey of the north and south outlines of township 47, range 9, west of the second meridian.
Aylsworth, C. F.	Madoc, Ont.	Retracement in townships 13, 14 and 15, range 6, east of the principal meridian; survey of lots in Turtle Mountain and Moose Mountain forest reserves.
Baker, J. C.	Kingston, Ont.	Contract No. 15 of 1911. Subdivision of townships 56, 57, 58, 59 and 60, range 17, and township 57, range 18, west of the third meridian.
Belanger, P. R. A.	Ottawa, Ont.	Inspection of contracts Nos 2 and 3 of 1910. Contracts Nos. 3, 8 and part of contract No. 5 of 1911. Settlement survey at Fisher Bay in township 29, range 2, east of the principal meridian. Subdivision of parts of township 16, range 16, and townships 15 and 16, range 17, east of the principal meridian. Resurvey in township 33, range 8, and townships 31 and 32, range 9, west of the principal meridian.
Bennett, G. A.	Eden, Ont.	Subdivision in townships 13 and 14, range 29, west of the second meridian. Retracement in townships 9 and 10, ranges 10 and 11, townships 7 and 8, range 15, township 8, range 16, township 20, range 17, and townships 10 and 11, range 19, west of the second

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
		meridian; township 13, range 4, township 25, range 6, townships 13 and 16, range 14, township 19, range 15, and township 26, range 20, west of the third meridian; township 21, range 1, townships 10 and 11, range 5, townships 10, ranges 6 and 10, and township 8, range 21, west of the fourth meridian. Resurvey in township 16, range 13. townships 27 and 28, ranges 14 and 15, township 26, range 23, and township 33, range 26, west of the third meridian; townships 16, ranges 3 and 4, townships 14 and 15, range 10, township 19, range 21, and township 18, range 26, west of the fourth meridian. Investigation in township 15, range 3, and townships 11 and 15, range 4, west of the fourth meridian. Traverse in township 25, range 5, west of the third meridian; townships 14, ranges 21 and 22, and townships 36, ranges 24 and 25, west of the fourth meridian.
Blanchet, G. H..	Ottawa, Ont..	Survey of the twenty-third base line between the fourth and fifth meridians.
Brenot, L..	Ottawa, Ont..	Survey of the western boundary of the Peace River block from the twenty-first base line to the northwest corner of the block.
Bridgland, M. P..	Calgary, Alta..	Triangulation survey in the railway belt, British Columbia. Survey of villa lots at Banff. Investigation in township 27, range 1, and township 24, range 8, west of the fifth meridian.
Carson, P. A..	Ottawa, Ont..	Stadia traverse of North Lillooet river in township 12, east of the coast meridian.
Cautley, R. H..	Edmonton, Alta..	Contract No. 23 of 1911. Subdivision of township 49, range 12, townships 49, 50 and 51, range 13, and townships 50 and 51, range 14, west of the fifth meridian.
Chase, A. V...	Orillia, Ont..	Examination of lands in the Kamloops district of the railway belt, British Columbia, for the purpose of classification into fruit land, farming land, grazing land, timber land and worthless land. Subdivision in township 14, range 23, township 15, range 26, and townships 14 and 15, range 27, west of the sixth meridian. Traverse in township 15, range 26, and townships 13, 14 and 15, range 27, west of the sixth meridian.
Christie, Wm....	Prince Albert, Sask. .	Contract No. 11 of 1911. Subdivision of townships 53, 54 and 55, range 8, townships 51, 52 and 53, range 9, and survey of the east outline of township 56, range 9, west of the third meridian.
Cote, J. L..	Edmonton, Alta..	Contract No. 21 of 1911. Subdivision of townships 45, 46 and 47, range 7, township 48, range 8, and townships 48 and 49, range 9, west of the fifth meridian. Contour survey of the townsite of Fitzhugh, in township 45, range 1, west of the sixth meridian.
Cumming, A. L..	Cornwall, Ont..	Retracement surveys in townships 7, ranges 23 and 24, west of the third meridian; township 44, range 4, township 48, range 10, townships 48 and 49, range 11, townships 50, ranges 13 and 14, and townships 44 and 45.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
		range 15, west of the fourth meridian. Subdivision of parts of township 19, range 7, and township 20, range 8; survey of part of the east outline of township 20, range 7, west of the fifth meridian. Traverse in townships 44 and 45, range 15, west of the fourth meridian, and townships 19 and 20, range 7, west of the fifth meridian.
Davies, T. A..	Edmonton, Alta..	Contract No. 19 of 1911. Subdivision of townships 67, 68 and the north third of 66, ranges 10, 11 and 12, west of the fourth meridian. Retracement of lots in Lac la Biche settlement in township 67, range 12, west of the fourth meridian.
Day, H. S..	St. John, N.B...	Settlement surveys at Pelican, Grand Rapids, McMurray, McKay and Chipewyan, on Athabaska river. Traverse of part of Athabaska river near McKay.
Deans, W. J...	Brandon, Man...	Subdivision in township 8, range 26, and townships 2, 3 and 4, range 29, west of the sixth meridian; townships 2 and 38, west of the coast meridian; and townships 14, 17, 18, 19, 20, 22 and 25, east of the coast meridian. Resurvey in townships 2 and 3, range 29, west of the sixth meridian; townships 2 and 38, west of the coast meridian; and townships 17, 18, 19, 20, 22 and 23, east of the coast meridian. Traverse in township 8, range 26, and township 2, range 29, west of the sixth meridian, and townships 20, 22 and 25, east of the coast meridian.
		Survey of timber berth No. 544, in township 2, west of the coast meridian and berth No. 553, in townships 17 and 18, east of the coast meridian.
Fairchild, C. C... ...	Brantford, Ont..	Contract No. 27 of 1911. Subdivision of townships 57, ranges 14, 15, 16 and 17, and township 56, range 18, west of the fifth meridian.
Fletcher, J. A..	Ottawa, Ont..	Latitude observations along the principal meridian in townships 35 and 48, and along the fourth meridian in townships 62 and 89.
Fontaine, L. E...	Levis, Que..	Inspection of contracts Nos. 15, 29, 30 and 31 of 1910, and contracts Nos. 21, 22, 23, 24, 27 and part of Nos. 20 and 28 of 1911. Re-inspection of contracts Nos. 22 and 23 of 1909. Correction survey in township 47, range 5, and townships 48 and 49, range 6, west of the fifth meridian.
		Survey of part of timber berth No. 1727, in townships 48 and 49, range 6, west of the fifth meridian.
Francis, J.	Portage la Prairie, M...	Subdivision of parts of townships 43 and 44, range 20, townships 45 and 46, range 23, and township 46, range 24, west of the fifth meridian.
Gibbon, Jas..	Vancouver, B.C..	Contract No. 2 of 1911. Subdivision of townships 28 and 29, ranges 7 and 8, and township 29, range 9, west of the principal meridian.
Green, T. D..	Ottawa, Ont..	Contract No. 20 of 1911. Subdivision of townships 41, 42, 43 and 44, range 7, township 41, range 8, and township 39, range 9, west of the fifth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
		Survey of timber berth No. 1788 in townships 40 and 41, range 9, west of the fifth meridian.
Hawkins, A. H.	Listowel, Ont.	Survey of the twenty-second base line across ranges 1 to 20, west of the fifth meridian.
Heathcott, R. V.	Edmonton, Alta.	Contract No. 26 of 1911. Subdivision of townships 49 and 50, range 20, and township 50, range 21, part of township 49, range 21, and the south third of townships 51, ranges 19, 20 and 21, west of the fifth meridian.
Herriot, G. H.	Ottawa, Ont.	Subdivision in township 48, range 26, and townships 48 and 49, range 27, west of the fifth meridian. Correction surveys in townships 51 and 52, range 24, west of the fifth meridian. Contour survey of the land adjoining the Fiddle Creek hot springs in Jasper Forest Park reserve in western Alberta.
Holcroft, H. S.	Toronto, Ont.	Contract No. 29 of 1911. Subdivision of township 73, range 16, townships 73, 76 and portions of 74 and 75, range 17, townships 74, 75 and 76, range 18 and part of township 76, range 19, and survey of the east outline of township 73, range 19, west of the fifth meridian.
Hubbell, E. W.	Ottawa, Ont.	Inspection of contracts Nos. 9, 10, 12, 13, 15 and 16 of 1911; partial inspection of contracts No. 6 of 1910 and No. 11 of 1911. Part subdivision of township 52, range 16, west of the third meridian. Resurvey in townships 45, ranges 27 and 28, west of the second meridian, and townships 45 and 46, range 5, west of the third meridian. Traverse in township 52, range 17, west of the third meridian.
Inkster, O.	Edmonton, Alta.	Contract No. 28 of 1911. Subdivision of townships 56, ranges 19, 20 and 21, townships 55, 56 and the north third of 54, range 22, and the south two-thirds of township 54, range 23, west of the fifth meridian.
Kimpe, M.	Edmonton, Alta.	Contract No. 22 of 1911. Subdivision of townships 48 and 49, range 10, townships 48, 49, 50 and 51, range 11, and townships 48, 50 and 51, range 12, west of the fifth meridian. Survey of timber berth No. 1749 in townships 42 and 43, ranges 13 and 14, west of the fifth meridian.
Laurie, R. C.	Battleford, Sask.	Contract No. 13 of 1911. Subdivision of townships 50, 51 and 52, range 11, and townships 52, ranges 12 and 13, west of the third meridian.
Lighthall, A.	Vancouver, B.C.	Subdivision in township 7, range 29, west of the sixth meridian; township 6, range 4, and townships 4, 5, 6 and 7, range 5, west of the seventh meridian; townships 40 and 41, east of the coast meridian. Resurvey in township 7, range 29, west of the sixth meridian; townships 4 and 6, range 5, west of the seventh meridian; townships 15, 40 and 41, east of the coast meridian. Traverse in township 7, range 29, west of the sixth meridian; township 6, range 4, and townships 4, 5 and 6, range 5, west of the seventh meridian; townships 15, 40 and 41, east of the coast meridian.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, t
March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
		Levelling along the street lines at Woodhaven on Bedwell bay, British Columbia.
		Survey of timber berth No. 547 in township 7, range 29, west of the sixth meridian; timber berths Nos. 546, 548 and 549, in township 6, ranges 4 and 5, west of the seventh meridian.
Lonergan, G. J..	Buckingham, Que.. ..	Inspection of contracts Nos. 27, 28, 32 and 33 of 1910, and contracts Nos. 29, 30, 31 and 32 of 1911. Miscellaneous resurveys in townships 50, 51 and 53, range 27, and townships 50, 51, 53 and 54, range 28, west of the fourth meridian. Correction survey at St. Albert settlement.
McFarlane, J. B... ..	Toronto, Ont..	Production of the fourth meridian from the northeast corner of section 13, township 95 to the northeast corner of township 105
		Survey of the twenty-fourth base line across ranges 1, 2, 3 and 4, west of the fourth meridian.
McFarlane, W. G... ..	Toronto, Ont..	Contract No. 32 of 1911. Subdivision of townships 77, 78, 79 and 80, ranges 13, 14 and 15, west of the sixth meridian.
McGrandle, H...	Wetaskiwin, Alta... ..	Contract No. 25 of 1911. Subdivision of township 51, range 17 and townships 49, 50 and the south third of 51, range 18, west of the fifth meridian.
MacLennan, A. L.. ...	Toronto, Ont..	Subdivision of townships 56, ranges 25 and 26 and part subdivision of township 57, range 26 and township 56, range 27, west of the principal meridian. Mounding along the fifteenth base line in ranges 25 and 26, west of the principal meridian. Traverse in townships 56, ranges 24, 25 and 26, west of the principal meridian.
		Survey of booming site on Carrot river, in townships 56, ranges 26 and 27, west of the principal meridian.
McMillan, Geo..	Ottawa, Ont..	Production of the twenty-first base line across ranges 13 to 26, west of the sixth meridian.
		Survey of the west boundary of the Peace River block from the twenty-first base line to the southwest corner of the block.
McNaughton, A. L.. ..	Cornwall, Ont..	Part subdivision of townships 46, ranges 18 and 19, townships 47 and 48, range 20, and township 48, range 21, west of the fifth meridian
		Survey of the east outline of township 45, range 20, west of the fifth meridian.
Martindale, E. S.. ...	Kingsmill, Ont..	Part subdivision of township 17, ranges 4 and 5, townships 17 and 18, range 6, and townships 18 and 19, range 7, west of the fifth meridian. Resurvey in township 23, range 33, west of the principal meridian. Correction survey in township 52, range 4, and townships 36 and 37, range 12, west of the third meridian. Retracement survey in townships 7, ranges 3, 4 and 5, west of the fourth meridian. Traverse of south Saskatchewan river across township 48, range 21A, west of the second meridian.
Matheson, H..	Ottawa, Ont..	Correction survey in townships 52 and 53 range 21, townships 51, 52 and 53, range 22 and townships 52 and 53, range 23, west of the fifth meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
Miles, C. F....	Toronto, Ont..	Inspection of contracts Nos. 14, 20 and 22 of 1910. Contracts Nos. 17, 18 and 19 of 1911, and part of contract No. 10 of 1910. Re-inspection of contract No. 26 of 1909. Subdivision in townships 61 and 62, range 3, west of the fourth meridian. Retracement in townships 15, 16 and 17, range 27, west of the second meridian and in township 14, range 26, west of the third meridian.
Moberly, H. K..	Moosomin, Sask..	Survey of timber berths Nos. 1681 and 1682 in township 44, range 9, townships 44 and 45, range 10, and township 45, range 11, west of the second meridian.
Montgomery, R. H. ..	Prince Albert, Sask...	Contract No. 10 of 1911. Subdivision of townships 53, 54 and 55, range 6, townships 54 and 55, range 7 and survey of the east outlines of townships 56, ranges 6, 7 and part of 8, west of the third meridian. Survey of timber berth No. 1686 in townships 51, ranges 4 and 5, west of the third meridian.
Morrier, J. E....	Ottawa, Ont..	Contract No. 9 of 1911. Subdivision of townships 53 and the south two-thirds of 54, ranges 25 and 26, townships 53, ranges 27 and 28, west of the second meridian, and the east half of township 53, range 1, west of the third meridian. Survey of timber berth No. 1785 in townships 44, 45 and 46, range 11, townships 44 and 45, range 12, and township 44, range 13, west of the second meridian.
Nash, T. S..	Ottawa, Ont..	Investigation survey in township 2, range 21, west of the principal meridian.
Pequegnat, M..	Berlin, Ont..	Contract No. 3 of 1911. Subdivision of township 33, range 8, and townships 32 and 33, ranges 9 and 10, west of the principal meridian.
Plunkett, T. H..	Meaford, Ont....	Correction survey and mounding along the fifth meridian through townships 93 to 110, inclusive, and portions of townships 81, 92, 111 and 112; the twenty-eighth base line across ranges 1, 2 and part of 3, and the twenty-ninth base line across part of range 1, west of the fifth meridian.
Ponton, A. W..	Edmonton, Alta..	Production of the principal meridian from the thirteenth to the sixteenth base line.
Powell, W. H..	Ottawa, Ont..	Contract No. 14 of 1911. Subdivision of townships 61, ranges 12, 14 and 15, and the south two-thirds of townships 62, ranges 12, 13, 14 and 15, west of the third meridian.
Purser, R. C..	Windsor, Ont..	Subdivision in township 52, range 20, west of the fourth meridian. Miscellaneous resurveys in township 6, range 9, townships 5 and 25, range 29 and township 8, range 31, west of the principal meridian; township 5, range 7 and township 33, range 21, west of the second meridian; township 36, range 2, township 34, range 3, and township 36, range 6, west of the third meridian; township 43, range 1, township 45, range 2, township 43, range 4, township 44, range 5, township 41, range 9, and township 49, range 20, west of the fourth meridian. Traverse in township 38, range 19, west of the second meridian, and township 43, range 2, west of the third meridian.

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
Ransom, J. T.	Toronto, Ont.	Contract No. 5 of 1911. Subdivision of township 39, range 4, township 39 and the south two-thirds of township 40, range 5, and townships 39 and 40, ranges 6 and 7, west of the second meridian.
Rinfret, C.	Montreal, Que.	Retracement surveys in township 17, range 16, townships 17, ranges 17 and 19, township 17, range 18, townships 16, ranges 21 and 22, townships 15 and 16, range 23, townships 14, 15 and 16, range 24, townships 17 and 18, range 25, townships 15, 16, 17 and 18, range 26, and township 18, range 27, west of the second meridian. Resurvey in township 25, range 29, township 29, range 31, and townships 32, ranges 32 and 33, west of the principal meridian; township 30, range 14, and township 16, range 25, west of the second meridian, township 23, range 6, township 22, range 9, and townships 14 and 15, range 28, west of the third meridian; township 26, range 16, west of the fourth meridian. Traverse in township 32, range 1, west of the second meridian, and township 28, range 15, west of the fourth meridian.
Robinson, E. W.	Ottawa, Ont.	Survey of the second meridian from the northeast corner of township 61, to the northeast corner of section 1, township 68. Production of the fifteenth base line across ranges 1 to 21, west of the second meridian.
Rolfson, O.	Walkerville, Ont.	Production of the twenty-second base line across ranges 13 to 26, west of the sixth meridian; survey of the east outlines of townships 83 and 84, and retracement of part of the east outline of township 82, range 13, west of the sixth meridian.
Ross, J. E.	Kamloops, B.C.	Subdivision in townships 16, 17 and 18, range 14, and townships 16 and 19, range 15, west of the sixth meridian.
Roy, J. E.	Quebec, Que.	Contract No. 12 of 1911. Subdivision of townships 49 and 50, range 9 and townships 50, 51 and 52, range 10, west of the third meridian.
Saint Cyr, A.	Ottawa, Ont.	Survey of the seventeenth base line across ranges 13 to 26, and subdivision surveys in townships 65, ranges 26 and 27, west of the third meridian. Reposting along fourth meridian through townships 61, 62 and 63.
Scott, W. A.	Galt, Ont.	Subdivision in townships 32 and 33, range 10 and township 32, range 11, west of the third meridian; townships 9, 10, 12 and 13, range 4, and survey of the east outline of township 11, range 5, west of the fifth meridian. Correction survey in township 26, range 15, west of the third meridian.
		Retracement in townships 7 and 8, range 6, township 8, range 7, townships 45 and 46, range 16, township 45, range 17, and township 60, range 25, west of the fourth meridian. Traverse in township 41, range 13, west of the fourth meridian.
Smith, J. H.	Edmonton, Alta.	Contract No. 31 of 1911. Subdivision of township 83 and part of township 82, range 24, townships 82 and 83 and survey of the east

APPENDIX No. 1—*Continued*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Continued.*

Surveyor.	Address.	Description of Work.
		outlines of townships 84, ranges 25 and 26, west of the fifth meridian; township 79, range 3, townships 75, 76, 78, 79 and the north third of township 74, range 4, and townships 75, 76 and the north third of 74, range 5, west of the sixth meridian.
Steele, I. J..	Ottawa, Ont..	Contract No. 31 of 1911. Subdivision of townships 61 and the south two-thirds of township 62, ranges 24, 25, 26 and 27, west of the third meridian.
Stewart, L. D. N.. ..	Saskatoon, Sask.... ..	Contract No. 8 of 1911. Subdivision of townships 49, 50, 51, 52 and 53, range 11, west of the second meridian.
Stewart, W. M..	Saskatoon, Sask..	Contract No. 16 of 1911. Subdivision of townships 58, 59 and 60, ranges 18 and 19, and survey of the east outline of township 57, range 18, west of the third meridian.
Stock, J. J...	Ottawa, Ont..	Contract No. 30 of 1911. Subdivision of townships 77, 78, 79 and 80, range 17, township 80, range 18, and portions of townships 75, 76 and 77, range 16, west of the fifth meridian.
Street, P. B..	Toronto, Ont....	Subdivision in township 5, range 4, and townships 5 and 8, range 5, west of the fifth meridian. Retracement in townships 21, ranges 4 and 5, and township 23, range 6, west of the principal meridian; townships 2, ranges 11 and 12, townships 1 and 2, range 13, townships 2, ranges 14 and 15, and townships 7, ranges 29 and 30, west of the fourth meridian Correction survey in township 9, range 21, west of the second meridian. Traverse in township 23, range 3, east of the principal meridian and township 4, range 1, west of the fifth meridian.
Taggart, C. H..	Ottawa, Ont..	Subdivision in townships 23 and 24, range 18, and townships 24 and 25, ranges 19 and 20, west of the fifth meridian; township 23, range 1, townships 22 and 23, range 2, townships 17, ranges 12 and 13, townships 17 and 18, range 14, townships 16, 17 and 18, ranges 15 and 16, township 16, range 17, and townships 17, ranges 18 and 19, west of the sixth meridian. Resurvey in townships 21, 22 and 23, range 1, townships 22 and 23, range 2, and township 16, range 17, west of the sixth meridian. Traverse in township 23, range 18 and township 21, range 29, west of the fifth meridian; townships 21 and 22, range 1, townships 22 and 23, range 2, township 20, range 6, township 22, range 17 and township 17, ranges 18 and 19, west of the sixth meridian. Survey of timber berth No. 545 in township 23, range 18, west of the fifth meridian and timber berth No. 550 in township 20, range 6, west of the sixth meridian.
Teasdale, C. M..	Concord, Ont..	Part of contract No. 3 of 1910. Subdivision of township 39, range 10, west of the second meridian.
Thompson, W. T.. ..	Grenfell, Sask..	Survey of timber berths Nos. 1666, 1667, 1668, 1669, 1670 and 1671 near Sipanok channel in eastern Saskatchewan, and timber berth No. 1790 in township 38, range 28, west of the principal meridian.

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APPENDIX No. 1—*Concluded.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1911, to March 31, 1912—*Concluded.*

Surveyor.	Address.	Description of Work.
Waddell, W. H..	Edmonton, Alta..	Contract No. 17 of 1911. Subdivision of townships 58, 59 and 60, range 22, townships 59 and 60, range 23, and township 60, range 24, west of the third meridian.
		Contract No. 39 of 1911. Subdivision of townships 58, 59 and 60, ranges 20 and 21, west of the third meridian.
Waldron, J..	Moosejaw, Sask..	Contract No. 6 of 1911. Subdivision of township 40 and the north third of township 39, range 8, townships 38 and 40, and the west halves of townships 39 and 41, range 9, the east third of township 41, range 10, the west half of township 41, range 11 and township 41, range 12, west of the second meridian.
Walker, C. M..	Guelph, Ont..	Retracement in townships 13 and 14, range 7, west of the principal meridian. Subdivision in townships 21, 22 and 23, range 6, west of the fifth meridian. Mounding in township 24, range 6, west of the fifth meridian.
Wallace, J. N..	Calgary, Alta..	Levelling northerly from Prince Albert and Lloydminster along the third and the fourth meridians.
Young, W. H....	Lethbridge, Alta..	Contract No. 24 of 1911. Subdivision of township 49, range 14, townships 49, 50 and 51, range 15, and township 51, range 16, west of the fifth meridian.

APPENDIX No. 2.

SCHEDULE showing for each surveyor employed from April 1, 1911, to March 31, 1912, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey, also the cost of the same.

Surveyor.	Miles of section lines.	Miles of outlines.	Miles of traverse.	Miles of resurvey	Total mileage	Total cost.	Cost per mile.	By day work or by contract.
						$	$ cts.	
Akins, J. R	83	49		2	134	27,800	207 46	Day
Allison, C. B	281	20	131		432	9,997	23 14	Contract.
Aylen, J	216	18	18	5	257	7,582	29 50	"
Aylsworth, C. F			25	54	79	9,554	120 94	Day.
Baker, J. C	277	36	14		327	9,556	29 22	Contract.
Bennett, G. A	4		35	168	207	5,232	25 28	Day.
Blanchet, G. H		150			150	26,340	175 60	"
Brenot, L	39	31			70	17,431	249 01	"
Cautley, R. H	296	36	23		355	10,539	29 69	Contract.
Christie, Wm.	280	33	145		458	11,225	24 51	"
Côté, J. L	282	24			306	9,119	29 80	"
Cumming, A. L	44		37	144	225	12,193	54 19	Day
Davies, T. A	33	42	110		486	12,483	25 69	Contract.
Day, H. S			93		93	7,875	84 68	Day.
Deans, W. J	29		29	23	81	8,525	105 25	"
Fairchild, C. C	234	24			258	8,722	33 81	Contract.
Francis, J	117	5	8	12	140	10,907	77 91	Day.
Gibbon, Jas	230		39	3	275	7,117	25 88	Contract.
Green, T. D	282	30	31	8	351	9,227	26 29	"
Hawkins, A. H		120			120	18,938	157 82	Day.
Heathcott, R. V	231	40	111		382	9,330	24 42	Contract.
Herriot, G. H	27	3	13	18	61	8,181	134 11	Day.
Holcroft, H. S	347	42	22		411	12,197	29 68	Contract.
Inkster, O	264	24	41		329	9,178	27 90	"
Kimpe, M	426	42	60		528	14,881	28 18	"
Laurie, R. C	199	12	54		265	6,692	25 25	"
Lighthall, A	29		1	33	63	8,939	148 98	Day.
MacLennan, A. L	103	11	70	26	210	6,525	31 07	"
Martindale, E. S	57	12	6	134	209	10,753	51 45	"
Matheson, H			42	109	152	3,579	23 55	"
McFarlane, J. B		88			88	22,717	258 15	"
McFarlane, W. G	586	96	70		752	19,395	25 79	Contract.
McGrandle, H	150	28			178	5,566	31 27	"
McMillan, Geo	25	44		4	73	19,653	269 22	Day.
McNaughton, A. L	86	18	7		111	10,564	95 17	"
Montgomery, R. H	261	60	206	6	533	12,310	23 10	Contract.
Morrier, J. E	236	36	80		352	9,304	26 43	"
Pequegnat, M.	210	21	15	10	256	7,030	27 46	"
Plunkett, T. H				130	130	17,661	135 85	Day.
Ponton, A. W		72			72	14,233	197 68	"
Powell, W. H	278	50	164		492	12,063	24 52	Contract.
Purser, R. C	10		47	80	137	4,940	36 06	Day.
Ransom, J. T	335		18	6	359	10,685	29 76	Contract.
Rinfret, C			16	787	803	10,840	13 50	Day.
Robinson, E. W		163			163	16,753	102 78	"
Rolfson, O		90		2	92	26,944	292 87	"
Roy, J. E	240	12	214		466	10,045	21 56	Contract.
Saint Cyr, A	9	82		15	106	13,879	130 93	Day.
Scott, W. A	30	24	8	168	230	9,467	41 16	"
Smith, J. H	555	79	58	2	694	18,967	27 33	Contract.
Steele, I. J	300	40	126		466	11,921	25 58	"
Stewart, L. D. N	240	36	27		303	8,866	29 26	"
Stewart, W. M	295	48	37		380	10,934	28 77	"
Stock, J. J	324	54	18		396	11,492	29 02	"
Street, P. B	10	4	5	288	307	8,746	28 49	Day.
Taggart, C. H	57		38	20	115	10,426	90 66	"
Teasdale, C. M	48		12		60	1,580	26 33	Contract.
Waddell, W. H	566	36	225		827	19,554	23 64	"
Waldron, J	290			1	291	8,570	29 45	"
Walker, C. M	75	26	9	22	132	11,348	85 97	Day.
Young, W. H	212	30	10	6	258	8,177	31 69	Contract.
Total	10,098	2,041	2,577	2,317	17,033	715,247		

APPENDIX No 3.

List of lots in the Yukon Territory, survey returns of which have been received from April 1, 1911, to March 31, 1912.

GROUP No. 2.

Lot No.	Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
228	10 60	F. H. Kitto.....	1911	Apr. 12, 1912 .	Granville Power Co..... .	Surface.
295	1 60	" ...	1911	Mar. 21, 1912.	Chas. Fisher..... ...	Surface.
298	160 00	"	1911	Mar. 21, 1912 ..	Chas. Fisher...	Surface.
321	51 65	" .. .	1911	Apr. 12, 1912 .	Granville Power Co.....	"Husky" Min. Cl.
322	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Whiteside" "
323	51 65	" .. .	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Boyle" "
324	51 65	"	1911	Apr. 12, 1912...	Granville Power Co.....	"Kitto" "
325	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Alexander" "
326	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Granville" "
333	51 65	" ..	1911	Apr. 12, 1912	Granville Power Co	"Morgan" "
334	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Maggie" "
335	51 65	" ..	1911	Apr. 12, 1912 ..	Granville Power Co.....	"North Fork" "
336	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"Elma" "
357	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.....	"White Channel John," Min. Claim
338	51 65	"	1911	Apr. 12, 1912 ..	Granville Power Co.	"Stella" "
340	22 3	" ...	1911	Apr. 12, 1912 ..	John Lee	Surface.

GROUP No. 5.

115	45 56	H. G. Dickson.	1908	Jan. 2, 1912....	William Clark	"Verona" Mineral Claim.
162	43 39	" .	1912	Apr. 12, 1912.	H. G. Dickson	"Spring Creek" "
173	160 00	" ..	1910	Sept. 26, 1911...	Karl Werk	"Keewenaw" "
174	51 65	" ..	1910	Sept. 26, 1911..	"	"Gladstone" "
175	37 19	" ..	1910	Jan. 5, 1912....	"	Surface.
201	50 02	" ..	1910	Sept. 26, 1911...	"	"Northwest" Mineral Claim.
202	46 50	" ..	1910	Sept. 26, 1911...	"	"Poppy" "
203	41 64	" ..	1910	Sept. 26, 1911...	"	"Leary" "
204	50 06	" ..	1910	Sept. 26, 1911...	"	"Evening Star" "
205	46 53	" ..	1910	Sept. 26, 1911...	"	"Monteray" "
206	51 65	" ..	1910	Sept. 26, 1911...	"	"Star Ruby" "
207	44 71	" ..	1910	Sept. 26, 1911...	"	"Wild Rose" "
208	51 65	" ..	1910	Sept. 26, 1911. .	"	"Big Four" "
209	50 58	" ..	1910	Sept. 26, 1911. .	"	"Alice" "
210	50 90	" .	1910	Sept. 26, 1911.	"	"Solo" "
211	43 67	" ..	1910	Sept. 26, 1911...	"	"Brimstone No. 1 Min. Cl.
212	50 24	" .	1910	Sept. 26, 1911...	"	"King Bee" "
213	23 39	" ..	1910	Sept. 26, 1911..	"	"J. C." "
214	44 62	" ..	1910	Sept. 26, 1911. .	"	"Vivian" "
215	33 76	" ..	1910	Sept. 26, 1911 .	"	"White Pass" "
216	38 02	" ..	1910	Sept. 26, 1911. .	"	"Skagway" "
217	40 45	" ..	1910	Sept. 26, 1911 .	"	"Yukon" "
218	24 94	" ..	1910	Sept. 26, 1911 ..	"	"Bismarck" "
219	51 65	" .	1910	Sept. 26, 1911...	"	"Contact"
220	39 78	" ..	1910	Sept. 26, 1911..	"	"Zelandian" "
221	25 92	" ..	1910	Sept. 26, 1911...	"	"Rawhide" "
222	64 61	" ..	1911	Dec. 29, 1911...	J. O. Williams *et al*.....	"May" "
223	23 89	" ..	1911	Dec. 29, 1911 ..	"	"Shamrock" "

GROUP No 6.

Lot No.	Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
115	51 65	H. G. Dickson..	1910	.....	A. R. Auston *et al*.....	"Utah" Min.Claim.
116	51 08	" ..	1910	.....	"	"Rambler" "
117	45 38	" ..	1910	.....	"	"Montana" "
118	51 65	" ..	1910	.....	"	"Colorado" "
119	50 09	" ..	1910	.....	"	"Texas" "
120	49 68	" ..	1910	.....	"	"Reco" "

GROUP No. 10.

15	51·65	H. G. Dickson..	1910	May 31, 1911...	John McMeekin *et al*.....	"Bonanza" Min. Cl.
16	160 00	"	1910	May 31, 1911...	"	"County Antrim" Min. Claim.
17	51·65	"	1910	Jan. 5, 1912...	Karl Anderson.....	"Sunnyside" "
19	51·20	"	1910	May 31, 1911 ..	John McMeekin *et al*.	"Eldorado" "
20	43 81	" ...	1910	May 31, 1911...	"	"Hazel May" "
21	30 71	"	1910	May 31, 1911...	"	"Leroy" Fractional Min. Claim.
22	10·49	" ...	1911	Sept. 25, 1911...	S. Rawlinson.....	Surface.
27	31·82	"	1910	Apr. 12, 1912...	Thos. E. Bee *et al*.... ...	"North Star" M. Cl.
28	48 75	"	1910	Apr. 12, 1912...	"	"South Star" "
29	15 33	"	1910	Apr. 12, 1912...	"	Surface.
30	15·70	"	1910	May 31, 1911...	John McMeekin *et al*.....	"Star" Fract. M. Cl.
31	9 93	" .. .	1910	Sept. 25, 1911...	Thos. E. Bee...	Surface.
32	5·10	"	1910	Sept. 25, 1911...	C. F. Mack.....	Surface.

GROUP No. 15.

3	5·65	H. G. Dickson..	1911	Jan. 4, 1912...	Harry Chambers.....	Surface.

APPENDIX No. 4.

List of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1911, to March 31, 1912.

Year.	Surveyor.	Description of Survey.
1904	C. W. MacPherson.....	Yukon Crossing-Whitehorse division, in fifteen sections of ten miles each, of the Dawson-Whitehorse road.
1911	H. G. Dickson.....	Last division of Carmack's reference traverse for the Department of the Interior.

APPENDIX No. 5.

STATEMENT of work executed in the office of the Chief Draughtsman:—

Letters of instruction to surveyors	241
Progress sketches received and filed	1,142
Declarations of settlers received and filed	86
Returns of timber berths received	29
Plans received from surveyors	330
Field books received from surveyors	552
Timber reports received	235
Observations for magnetic declination received	746
Preliminary township plans prepared	328
Sketches made	5,995
Maps and tracings made	80
Plans of Yukon lots received	64
Plans of miscellaneous Yukon surveys received	16
Returns of surveys examined—	
Township subdivision	276
Township outline	252
Road plans	293
Railway plans	180
Yukon lots	64
Miscellaneous Yukon surveys	16
Mineral claims	51
Timber berths	49
Correction and other miscellaneous surveys	196
Township plans compiled	500
Townsite settlement and other plans compiled	19
Proofs of plans examined	34
Township plans printed	797
Townsite and settlement plans printed	11
Miscellaneous plans printed	106
Descriptions written	11
Areas calculated	1,635
Pages of field notes copied	343
Applications for various information dealt with	2,973
Files received and returned	1,848
Letters and memoranda drafted	8,711
Books received from Record Office and used in connection with office work	5,266
Books returned to Record Office	5,417
Plans other than printed township plans received from Record Office and used in connection with office work	951
Plans returned to Record Office	890
Volumes of plans received from Record Office and used in connection with office work	140
Volumes of plans returned to Record Office	129
Books sent to Record Office to be placed on record	484
Plans other than township plans sent to Record Office to be placed on record	137
Sectional maps (3 miles to 1 inch)—	
Revised	43
Reprinted	34
Sectional maps (6 miles to 1 inch)—	
Reprinted	23

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APPENDIX No. 6.

List of new editions of Sectional Maps compiled from April 1, 1911, to March 31, 1912.

Scale 3 miles to one inch.

No.	Name.	No.	Name.	No.	Name.	No.	Name.
18	Wood Mountain	119	Regina	172	Fairford	271	Mossy Portage
23	Emerson	120	Qu'Appelle	173	Washow	313	Brule
64	Porcupine	121	Riding Mountain	213	Athabaska	318	Shell River
65	Macleod	122	Manitoba House	214	Rocky Mt. House	319	Prince Albert North
68	Swift Current	123	Fort Alexander	216	Sullivan Lake	320	Carrot River
70	Moose Mountain	163	Donald	221	Swan River	366	Saddle Lake
71	Brandon	165	Rosebud	266	Ribstone Creek	462	Dunvegan
72	Portage la Prairie	169	Touchwood	269	Prince Albert South		
73	Winnipeg	170	Yorkton	270	Pasquia		

Scale 6 miles to one inch.

No.	Name.	No.	Name.	No.	Name.	No.	Name.
20	Souris	71	Brandon	169	Touchwood	219	Humboldt
21	Turtle Mountain	72	Portage la Prairie	172	Fairford	221	Swan River
64	Porcupine	73	Winnipeg	173	Washow	267	Battleford
68	Swift Current	118	Rush Lake	214	Rocky Mt. House	268	Carlton
69	Moose jaw	120	Qu'Appelle	216	Sullivan Lake	366	Saddle Lake
70	Moose Mountain	163	Donald	218	Saskatoon		

APPENDIX No. 7.

STATEMENT of work executed in the Photographic Office from April 1, 1911 to March 31, 1912.

—	3¼ x 3¼	3¼ x 5½	5 x 7	8 x 10	10 x 12	11 x 14	15 x 18	16 x 18	18 x 20	20 x 24	24 x 30	24 x 32	30 x 36	32 x 49	36 x 42	42 x 48	Total.
Dry plates and films		580	832			23											1,435
Bromide prints		18	4	17	5	344		80	96	13	24		24		38	69	732
Solio prints			1,081	202		29											1,312
Velox prints	366	6,522	3,664	13	57												10,622
Artura prints		332	1,027	4													1,363
Vandyke prints			8	10	13	18		56	82	48	62		114		99	9	519
Blue prints		42	8	25	74	47		85	90	79	140		104		61	98	853
Lantern transparencies	195																195
Photographs mounted		443	614	21	1	15		22	16		4						1,136
Wet plate negatives				67		174	105	978	116	21		2					1,463
Photo-litho plates									1,114					27			1,141
Totals	561	7,937	7,238	359	150	650	105	1,221	1,511	161	230	2	242	27	198	176	20,771

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APPENDIX No. 8.

STATEMENT of work executed in the Lithographic Office from April 1, 1911, to March 31, 1912.

Month.	Maps.			Township plans.			Forms.		
	No.	Copies.	Impressions.	No.	Copies.	Impressions.	No.	Copies.	Impressions.
1911.									
April	8	4,000	4,000	122	24,400	24,400	1	600	1,200
May	11	7,150	15,375	38	7,600	8,200	2	10,600	10,600
June	1	150	150	1	200	200	4	375	375
July	15	4,400	5,225	87	17,400	18,400	2	550	650
August	15	11,025	26,825	58	11,600	12,800	9	4,000	4,900
September	13	5,950	7,125	155	31,000	31,000	7	6,260	6,260
October	16	7,250	7,250	37	7,206	7,206	3	720	920
November	8	3,820	3,820	158	31,600	31,600	3	2,220	2,220
December	10	4,500	4,500	98	19,600	19,600	.....	.....	.....
1912.									
January	11	16,280	71,075	55	11,000	12,000	9	19,925	22,925
February	9	4,125	5,250	.....	.....	.....	4	2,500	2,500
March	17	87,825	156,140	32	6,400	6,400	6	15,200	15,200
Total	134	156,475	306,735	841	168,006	171,806	50	62,950	67,750

RECAPITULATION.

——	No.	Copies.	Impressions.	Cost.
Maps	134	156,475	306,735	2,734 00
Townships	841	168,006	171,806	4,060 00
Forms	50	62,950	67,750	850 00
Grand total	1,025	387,431	546,291	7,644 00

APPENDIX No. 9.

List of employes of the Topographical Surveys Branch at Ottawa, giving the name, classification, duties of office and salary of each. (Metcalfe street, corner of Slater.)

Name.	Classification.		Duties of Office.	Salary.
	Division.	Sub-division.		
				$
Deville, E., D.T.S., LL.D.	1	A	Surveyer General	3,650
	Correspondence.			
Brady, M.	1	B	Secretary	2,400
Cullen, M.J.	3	A	Stenographer	1,200
Moran, J. F.	3	A	Typewriter and clerk	900
Williams, E R	3	A	Correspondence clerk	900
Addison, W.G.	3	B	Typewriter	800
Pegg, A			Messenger	800
O'Meara, M.T.			"	550
Pick, A.C.			"	500
	Accounts.			
Hunter, R.H.	2	A	Accountant	2,100
Wilkinson, Percy	3	A	Asst. Accountant	1,100

Chief Draughtsman's Office—General direction and supervision of the technical work.

Shanks, T., B.A.Sc., D.L.S.	1	B	Chief draughtsman	2,550
Brown, T. E., B.A.	1	B	Asst. chief draughtsman	2,550

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Chief Draughtsman's Office, First Section—Survey instructions and general information.

Name.	Classification.		Duties of Office.	Salary.
	Division	Sub-division.		$
Barber, H. G., Grad. S.P.S.	2	A	Chief of section	1,900
Rice, F. W., Grad. School of Mining	2	A	Asst. chief of section	1,900
MacIlquham, W. L., B.Sc.	2	A	" "	1,900
Peaker, W. J., Grad. S.P.S.	2	A	" "	1,600
Sylvain, J.	2	A	" "	1,650
Carroll, M. J., Grad. S.P.S.	2	B	Draughtsman	1,600
Rochon, E. C.	2	B	"	1,400
McRae, A. D., B.A., B.Sc.	2	B	"	1,400
Grant, A. W., B.A.	2	B	"	1,400
Hayward, H. E., B.Sc.	2	B	"	1,300
Milliken, J. B., B.A., B.Sc.	2	B	"	1,300
MacMillan, J.P., B.E.	2	B	"	1,300
Wadlin, L. N., B.Sc.	2	B	"	1,200
Cordukes, J. P., B.Sc.	2	B	"	1,200
Gagnon, J. N. H., B.A.S.	2	B	"	1,050
Armstrong, W. B., B.Sc.	2	B	"	1,200
Spero, J. E.	2	B	"	1,200
Nevins, L. A., B.A.	2	B	"	1,200
McDonald, J. F., B.A.	2	B	"	1,200
Holbrook, C. H.	3	A	Clerk	950
Burkholder, E. L.	3	A	"	900

Chief Draughtsman's Office, Second Section—Surveys in Manitoba, Saskatchewan, Alberta and Yukon Territory.

Nash, T. S., Grad. S.P.S., D.L.S.	1	B	Chief of section	2,550
Burgess, E. L., Grad. S.P.S., D.L.S., O.L.S.	2	A	Asst. chief of section	1,900
Dennis, E. M., B.Sc.	2	A	" "	1,900
Elder, A. J., Grad. S.P.S., D.L.S.	2	A	" "	1,900
Henderson, F. D., Grad. S.P.S., D.L.S.	2	A	" "	1,900
Hill, S. N., Grad. S.P.S.	2	A	" "	1,900
Genest, P. F. X., Q.L.S.	2	A	" "	1,900
Robertson, D. F., Grad. S.P.S.	2	A	" "	1,900
Kitto, F.H., D.L.S.	2	A	" "	1,700
Sutherland, H. E., B.Sc.	2	A	In charge of Dawson office	1,600
McClennan, W. D.	2	B	Draughtsman	1,400
Roger, A., O.L.S.	2	B	"	1,600
Spreckley, R. O.	2	B	"	1,600
Goodday, Leonard.	2	B	"	1,500
Bray, R. P.	2	B	"	1,400
Harrison, E. W.	2	B	"	1,400
Ault, H. W.	2	B	"	1,300
Lytle, W. J.	2	B	"	1,300
LaBeree, E. E.	2	B	"	1,050
Jones, G. S., Grad. S.P.S., O.L.S.	2	B	"	1,050
Bradley, J. D.	2	B	"	1,050
Cagnat, G. H.	2	B	"	1,050
Fournier, O. E., B.A.S.	2	B	"	1,050
Thomas, A. S., B.Sc.	2	B	"	1,200
Smith, H. C.	2	B	"	1,200
Macdonald, J. A.	3	B	Clerk	800

Chief Draughtsman's Office, Third Section—(Imperial Building, Queen street).
Copying plans for reproduction.

Name.	Classification. Division	Classification. Sub-division.	Duties of Office.	Salary.
				$
Engler, Carl., B. A., D.L.S.	1	B	Chief of section	2,100
May, J. E.	2	A	Asst. chief of section	1,900
O'Connell, J. R.	2	A	Draughtsman	1,700
Moule, W. J.	2	B	"	1,600
Helmer, J. D.	2	B	"	1,100
Dawson, R. J.	2	B	"	1,100
Archambault, E.	2	B	"	1,100
Clarke, G. N.	2	B	"	800
Watters, James	3	A	Printer	1,200
McLennan, A. G.	3	A	Clerk	1,250
Brown, A.	3	A	"	900
Ebbs, E. J.	3	A	"	900
Baril, C.	3	B	Draughtsman	750

Chief Draughtsman's Office, Fourth Section—(Metcalfe street, corner of Slater).
British Columbia surveys.

Rowan-Legg, E. L.	2	A	Chief of section	2,050
Gillmore, E. T. B., Grad. R.M.C.	2	A	Asst. chief of section	2,000
Lawe, H., D.L.S.	2	A	" "	1,900
Morley, R. W.	2	A	" "	1,900
Weld, W. E.	2	A	" "	1,900
Wilson, E. E. D., B. Sc.	2	A	" "	1,600
Harris, K. D.	2	B	Draughtsman	1,300

Chief Draughtsman's Office, Fifth Section—(Imperial Building, Queen street).
Mapping.

Smith, J.	1	B	Chief of section	2,550
Begin, P. A.	2	A	Asst. chief of section	1,950
Flindt, A. H.	2	A	" "	1,700
Blanchet, A. E.	2	B	Draughtsman	1,600
Davies, T. E. S.	2	B	"	1,600
Perrin, V.	2	B	"	1,600
D'Orsonnens, A.	2	B	"	1,600
Davy, E.	2	B	"	1,400
Villeneuve, E.	2	B	"	1,100
Bergin, W.	2	B	"	1,100
Howie, Jas.	2	B	"	1,000
Purdy, W. A.	2	B	"	1,100
Brigly, J. H.	2	B	"	1,300

SESSIONAL PAPER No. 25b

Chief Draughtsman's Office, Sixth Section—(Imperial Building, Queen street).
Scientific and topographical work.

Name.	Classification. Division	Classification. Sub-division	Duties of Office.	Salary.
				$
Dodge, G. B., D.L.S	1	B	Chief of section	2,550
Coté, J. A., Grad. R.M.C	2	A	Asst. chief of section	1,600
Watt, G. H., Grad. S.P.S., D.L.S	2	A	" "	1,900
Blanchard, J. F	2	B	Draughtsman	1,050
Chartrand, D. E., B.Sc	2	B	"	1,100
Colquhoun, G.A., B.Sc	2	B	"	1,200
Cousineau, A., B.Sc	2	B	"	1,100
Dozois, L. O. R., Grad. R.M.C	2	B	"	1,100
Freeland, J. J., M.A	2	B	"	1,200
Herbert, W. H., B.Sc	2	B	"	1,200
Parry, H., B.Sc., D.L.S	2	B	"	1,000
Ross, R.C., B.Sc	2	B	"	1,200
Lynch, F. J	3	B	Typewriter	800
Watson, J. W	3	B	Clerk	750

Geographic Board (Woods Building, Slater street).

Whitcher, A. H., F.R.G.S., D.L.S	2	A	Secretary	2,100 00

Photographic Office (Metcalfe street, corner Slater street).

Carruthers, H. K	2	A	Process photographer	1,900
Woodruff, John	2	A	Chief "	1,900
Smith, L. G	2	B	Photographer	800
Whitcomb, H. E	3	A	"	1,200
Morgan, W. E	3	A	"	1,200
Kilmartin, A	3	A	Asst. photographer	900
Devlin, A	3	B	"	800
Ouimet, E. G	3	B	"	800

Lithographic Office (unclassified) (Metcalfe street, corner Slater street).

Name.	Occupation.	Salary.
Moody, A	Foreman	$27 00 per week.
Burnett, E	Lithographer	25 00 "
Thicke, C. R	"	23 00 "
Deslauriers, J. H	Transferrer	20 00 "
Bergin, J	Printer	21 00 "
Thicke, H. S	"	20 00 "
Boyle, S	Stone polisher	15 00 "
Gagnon, J	Press feeder	12 00 "
Kane, P	"	9 50 "
Easton, R. M	Printer	19 50 "
Hare, E. H	Asst. photographer	15 00 "

APPENDIX No. 10.

List of Dominion Land Surveyors who have been supplied with Standard Measures.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Akins, James Robert	Ottawa, Ont	Sept. 2, '76	Mar. 14, '10	
Allison, Calvin Bruce	SouthWoodslee, Ont.	June 16, '84	Mar. 28, 10	
Ashton, Arthur Ward	Ottawa, Ont	Nov. 5, '80	May 29, '08	
Austin, George Frederick	Not known		April 14, '72	
Aylen, John	North Bay, Ont.		May 29, '85	
Aylsworth, Charles Fraser	Madoc, Ont	April 21, '62	May 13, '86	O. L. S.
Baker, James Clarence	Vermilion, Alta.	May 12, '78	May 18, '06	
Baker, Mason Hermon	St. Thomas, Ont.	July 9, '84	Aug. 6, '08	O. L. S.
Bartlett, Ernest	Smithville, Ont.	'83	Jan. 16, '11	
Bayne, George A	Winnipeg, Man.	Oct. 25, '50	April 14, '72	M. L. S.
Beatty, David	Parry Sound, Ont.	Dec. 22, '42	April 14, '72	O. L. S.
Begg, William Arthur	Hamilton, Ont.	July 15, '82	June 8, '09	
Belanger, Phidime Roch Arthur	Ottawa, Ont	Mar. 5, '53	May 17, '80	Inspector of Surveys, Topographical Surveys Branch, Dept. of the Interior.
Belleau, Joseph Alphonse	Ottawa, Ont	Sept. 30, '56	May 15, '83	Topographical Surveys Branch, Dept. of the Interior.
Belyea, Albert Palmer Corey	Edmonton, Alta.		July 14, '09	
Bemister, George Bartlett	Winnipeg, Man.		June 11, '78	M. L. S. Engineering Dept. C. N. R.
Bennett, George Arthur	Eden, Ont	May 18, '86	Aug. 25, '10	
Berry, Edward Wilson	Seaforth, Ont.	Aug. 26, '81	May 18, '11	
Bigger, Charles Albert	Ottawa, Ont	Aug. 15, '53	Mar. 30, '82	B.C.L.S., O.L.S., Assistant Superintendent Geodetic Survey.
Bingham, Edwin Ralph	Fort William, Ont.	'78	Oct. 25, '06	O. L. S.
Blanchet, Guy Houghton	Ottawa, Ont	Feb. 12, '84	Mar. 10, '10	
Boswell, Elias John	Not known		Mar. 18, '03	O. L. S., M. L. S.
Bourgeault, Armand	St. Jean Port Joli, Que.	Feb. 23, '58	Mar. 29, '83	Q. L. S.
Bourgault, Charles Eugene	Lauzon, Levis, Que.	Sept. 6, '61	Feb. 21, '88	
Bourget, Charles Arthur	Lauzon, Que.	Aug. 26, '51	May 14, '84	Q. L. S.
Bowman, Edgar Peterson	West Montrose, Ont.		Sept. 26, '07	O. L. S.
Bowman, Herbert Joseph	Berlin, Ont.	June 18, '65	Feb. 16, '88	O. L. S.
Brabazon, Alfred James	Ottawa, Ont		May 13, '82	Boundary Survey, Dept. of the Interior.
Brady, James	Golden, B. C.	Nov. 24, '40	April 14, '72	O. L. S., B. C. L. S.
Bray, Samuel	Ottawa, Ont	Nov. 5, '46	Nov. 14, '83	O. L. S., Chief Surveyor, Dept. of Indian Affairs.
Bray, Lennox Thomas	Amherstburg, Ont.	Mar. 14, '77	Feb. 18, '03	O. L. S.
Brenot, Lucien	Ottawa, Ont	Aug. 31, '87	Mar. 18, '10	
Bridgland, Morrison Parsons	Calgary, Alta.	Dec. 20, '78	Mar. 10, '05	
Broughton, George Henry	Penticton, B.C.	Aug. 12, '86	June 3, '09	B. C. L. S.
Brown, Charles Dudley	Winnipeg, Man.	Feb. 25, '83	April 4, '10	
Brown, Edgar Carl	Regina, Sask.	Nov. 28, '86	May 23, '11	
Brown, Thomas Wood	Edmonton, Alta		June 21, '09	
Brownlee, James Harrison	Vancouver, B.C.	Mar. 22, '56	April 15, '87	M. L. S., B. C. L. S.
Bucknill, Walter Birch	Vancouver, B.C	May 8, '73	Mar. 19, '08	B. C. L. S.
Burd, James Henry	Weyburn, Sask.	Sept. 7, '71	May 18, '11	O. L. S., S. L. S.
Burgess, Edward LeRoy	Ottawa, Ont	May 5, '78	Feb. 23, '05	O. L. S., T. S. Branch, Dept. of Interior.
Burnet, Hugh	Victoria, B.C.		June 22, '85	O. L. S., B. C. L. S.
Burwash, Nathaniel Alfred	Whitehorse, Y.T.	Sept. 28, '79	Mar. 6, '07	O. L. S.
Burwell, Herbert Mahlon	Vancouver, B.C.	Oct. 23, '63	Feb. 17, '87	B. C. L. S.
Campbell, Alan John	Sidney, B.C.	Oct. 1, '82	April 13, '09	
Campbell, Alexander Stewart	Kingston, Ont	Mar. 7, '80	Mar. 6, '09	
Carbert, Joseph Alfred	Medicine Hat, Alta.	Feb. 4, '56	May 12, '80	O.L.S., District Engineer and Surveyor, Dept. of Public Works, Alberta.
Carpenter, Henry Stanley	Regina, Sask	Feb. 8, '74	Feb. 20, '01	Dept. of Public Works, O. L. S.
Carroll, Cyrus	Regina, Sask.	Dec. 6, '34	April 14, '72	O. L. S.

SESSIONAL PAPER No. 25b

APPENDIX No. 10.—*Continued.*

List of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission	Remarks.
Carson, Percy Alexander	Kamloops, B.C.	Dec. 25, '77	Feb. 22, '06	Hydrographic Survey.
Carthew, William Morden	Edmonton, Alta.	Oct. 19, '86	Mar. 29, '10	
Cautley, Reginald Hutton	Edmonton, Alta.	Dec. 6, '79	May 1, '05	
Cautley, Richard William	Edmonton, Alta.	Aug. 3, '73	Sept. 2, '96	
Cavana, Allan George	Orillia, Ont.	Jan. 22, '58	Nov. 16, '76	O.L.S.
Charlesworth, Lionel Clare	Edmonton, Alta.	Nov. 17, '73	Mar. 24, '03	O.L.S., Dept. of Public Works for Alberta.
Chase, Albert Victor	Orillia, Ont.	Mar. 4, '83	Oct. 11, '10	O.L.S.
Chilver, Charles Alonzo	Walkerville, Ont.	Feb. 8, '83	Feb. 22, '07	
Christie, William	Prince Albert, Sask.	Feb. 13, '76	Mar. 22, '06	
Clarke, Charles Wentworth	Regina, Sask.	Nov. 19, '75	Mar. 24, '10	
Cleveland, Ernest Albert	Vancouver, B.C.	May 12, '74	June 27, '99	B.C.L.S.
Coates, Preston Charles	Victoria, B.C.	May 16, '81	Apr. 19, 07	B.C.L.S.
Cokely, Leroy S.	Merritt, B.C.	Nov. 23, '84	Mar. 22, '10	
Cote, Joseph Adelard	Prince Albert, Sask.	June 5, '64	May 14, '84	
Cote, Jean Leon	Edmonton, Alta.	May 6, '67	Mar. 21, '90	
Cotton, Arthur Frederick	Nassett, B.C.	Aug. 8, '52	May 11, '80	O.L.S., B.C.L.S.
Craig, John Davidson	Ottawa, Ont.	Jan. 30, '76	Feb. 24, '02	Boundary Surveys, Dept. of the Interior.
Cumming, Austin Lewis	Cornwall, Ont.	Aug. 25, '82	Feb. 3, '10	
Cummings, Alfred	Fernie, B.C.	July 3, '80	Mar. 3, 09	B.C.L.S.
Cummings, John George	Cranbrook, B.C.	Nov. 19, '73	Feb. 17, '04	B.C.L.S.
Dalton, John Joseph	Weston, Ont.	June 12, '54	Apr. 17, '79	O.L.S., D.T.S.
Davies, Thomas Attwood	Edmonton, Alta.		Feb. 22, '06	
Dawson, Frederick James	Ashcroft, B.C.	Sept. 22, '86	Sept. 12, '10	
Day, Harry Samuel	St. John, N. B.	Nov. 14, '85	Mar. 9, '10	
Deans, Williams James	Brandon, Man.	May 4, '60	May 13, '86	O.L.S.
de la Condamine, C.	High River, Alta.	Feb. 13, '75	May 4, '10	
Dennis, John Stoughton	Calgary, Alta.	Oct. 22, '56	Nov. 19, '77	D.T.S.
Denny, Herbert C.	Not known.		Apr. 1, '82	
Dickson, Henry Godkin	Whitehorse, Y. T.	Mar. 29, '64	Mar. 19, '89	M.L.S.
Dickson, James	Fenelon Falls, Ont.	Oct. 30, '34	Apr. 14, '72	O.L.S.
Dobie, James Samuel	Thessalon, Ont.	Oct. 15, '73	Mar. 22, '06	O.L.S.
Doupe, Jacob Lonsdale	Winnipeg, Man.	Sept. 14, '67	Oct. 6, '88	M.L.S., Asst. Land Commissioner for C.P.R.
Drewry, William Stewart	Nelson, B.C.	Jan. 20, '59	Nov. 14, '83	O.L.S., B.C.L.S.
Driscoll, Alfred	Edmonton, Alta.	July 2, '65	Feb. 23, '87	B.C.L.S.
Drummond, Thomas	Montreal, P.Q.	1856	June 24, '78	D.T.S.
Ducker, William A	Winnipeg, Man.	Apr. 4, '52	Mar. 30, '83	O.L.S., M.L.S.
Dumais, Paul T. Concorde	Hull, P.Q.	Jan. 2, '47	Mar. 29, '82	Q.L.S.
Earle, Wallace Sinclair	Victoria, B.C.	Feb. 8, '89	May 18, '11	
Edwards, George	Ponoka, Alta.	June 13, '42	Apr. 14, '72	O.L.S.
Edwards, William Milton	Lethbridge, Alta.	June 21, '73	Apr. 5, '10	
Ellacott, Charles Herbert	Victoria, B.C.	Dec. 24, '66	Feb. 22, '99	B.C.L.S.
Empey, John Morgan	Calgary, Alta.	Apr. 16, '74	Feb. 23, '05	O.L.S.
Engler, Carl	Ottawa, Ont.	Sept. 30, '72	Feb. 23, '05	T.S. Branch, Dept. of Interior.
Fairchild, Charles Courtland	Brantford, Ont.	Feb. 21, '67	Feb. 20, '01	O.L.S.
Farncomb, Alfred Ernest	Edmonton, Alta.	May 22, '73	Mar. 12, '02	O.L.S.
Fawcett, Thomas	Ottawa, Ont.	Oct. 28, '48	Nov. 18, '76	O.L.S., D.T.S. Boundary Surveys, Dept. of Interior.
Fawcett, Adam	Gravenhurst, Ont.		Feb. 22, '93	
Ferguson, George Hendry	Toronto, Ont.	Jan. 20, '83	June 2, '09	
Findlay, Allan	Winnipeg, Man.	Oct. 15, '80	Mar. 21, '08	
Fletcher, James Allan	Fletcher, Ont.	Mar. 26, '89	May 18, '11	
Fontaine, Louis Elie	Levis, P.Q.	Oct. 3, '68	Nov. 30, '92	
Francis, John	Portage la Prairie, M	Dec. 22, '52	June 17, '75	M.L.S.
Galletly, James Simpson	Brooklin, Ont.	Apr. 15, '88	May 18, '11	
Garden, James Ford	Vancouver, B.C.	Feb. 19, '47	May 13, '80	B.C.L.S.
Garden, George H	Lethbridge,		Apr. 14, '72	Deputy Surveyor for N.B.
Garden, Charles	Not known.		Apr. 14, '72	Deputy Surveyor for N.B.

APPENDIX No. 10.—*Continued.*

List of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Garner, Albert Coleman	S. Qu'Appelle, Sask.	Sept. 6, '78	May 27, '07	
Gauvreau, Louis Pierre	Not known		Apr. 14, '72	
Gibbon, James	Vancouver, B.C.	June 25, '60	Feb. 12, '91	O.L.S.
Glover, Arthur Edward	Toronto, Ont.	Mar. 4, '87	Mar. 11, '11	
Gordon, Maitland Lockhart	Vancouver, B.C.		Feb. 18, '04	B.C.L.S.
Gordon, Robert John	Lethbridge, Alta.	June 18, '69	Mar. 12, '02	
Gore, Thomas Sinclair	Victoria, B.C.	1852	Apr. 19, '79	B.C.L.S.
Graham, John Robertson	Vancouver, B.C.	Apr. 18, '87	May 26, '10	
Gray, James Edward	Toronto, Ont.	Oct. 12, '81	Mar. 11, '11	
Green, Alfred Harold	Nelson, B.C.	Jan. 20, '79	Feb. 23, '05	B.C.L.S.
Green, Thomas Daniel	Ottawa, Ont.	Dec. 21, '57	May 19, '84	O. L. S.
Green, Frank Compton	Nelson, B. C.		May 8, '03	B. C. L. S.
Grover, George Alexander	Toronto, Ont.		Feb. 18, '04	
Hamilton, Charles Thomas	Vancouver, B. C.	July 29, '84	May 18, '11	
Hamilton, James Frederick	Lethbridge, Alta.	Apr. 4, '69	June 2, '09	
Harris, John Walter	Winnipeg, Man.	Feb. 26, '45	Apr. 14, '72	O. L. S., M. L. S., City Surveyor.
Harrison, Edward	Belleville, Ont.		May 14, '10	
Harvey, Charles	Kelowna, B. C.	May 5, '76	Feb. 17, '04	B. C. L. S.
Hawkins, Albert Howard	Listowel, Ont	July 27, '62	Mar. 6, '06	
Heaman, John Andrew	Winnipeg, Man.	June 3, '75	July 15, '09	O. L. S.
Heathcott, Robert Vernon	Edmonton, Alta.	July 7, '81	May 13, '07	
Henderson, Walter	Not known		Nov. 17, '83	
Herriot, George Henry	Souris, Man.	Feb. 23, '83	Sept. 18, '09	
Heuperman, Frederick Justinus	Calgary, Alta.	July 23, '87	Mar. 13, '11	
Heuperman, Lambertus Fred	Calgary, Alta.	Sept. 20, '81	Mar. 29, '10	
Hobbs, Wilfrid Ernest	Winnipeg, Man.	Mar. 12, '87	Mar. 5, '12	
Holcroft, Herbert Spencer	Toronto, Ont.	Sept. 4, '77	Feb. 18, '03	O. L. S.
Hopkins, Marshall Willard	Edmonton, Alta.	May 24, '61	Feb. 20, '01	O. L. S.
Hubbell, Ernest Wilson	Ottawa, Ont.	Nov. 5, '62	May 19, '84	Chief Inspector of Surveys, Topographical Surveys Branch, Dept. of Interior.
Inkster, Oluff	Edmonton, Alta.	Mar. 25, '85	May 18, '11	
James, Silas	Toronto, Ont.	June 19, '34	Apr. 14, '72	O. L. S.
Jephson, Richard Jermy	Brandon, Man.	Feb. 5, '54	May 12, '80	O. L. S., B. C. L. S.
Johnson, Alfred William	Kamloops, B. C.	Feb. 23, '74	Mar. 12, '02	B. C. L. S.
Keith, Homer Pasha	Edmonton, Alta.	Aug. 30, '85	Feb. 1, '11	
Kimpe, Maurice	Edmonton, Alta.	Jan. 17, '76	May 13, '07	
King, William Frederick	Dominion Observatory, Ottawa, Ont.	Feb. 19, '54	Nov. 21, '76	D.T.S. Chief Astronomer Dept. of Interior.
Kirk, John Albert	Summerland, B. C.	Jan. 9, '54	May 11, '80	O. L. S., B. C. L. S.
Kitto, Franklin Hugo	Dawson, Y. T.	Mar. 28, '80	Mar. 6, '08	
Klotz, Otto Julius	Dominion Observatory, Ottawa, Ont.	Mar. 31, '52	Nov. 19, '77	O. L. S., D. T. S., Astronomer, Dept. of Int.
Knight, Richard H	Edmonton, Alta	June 7, '77	Feb. 18, '04	
Lang, John Leiper	Toronto, Ont.		Oct. 14, '03	
Latimer, Frank Herbert	Penticton, B. C.	May 23, '60	Nov. 13, '85	
Laurie, Richard C	Battleford. Sask.	Jan. 31, '58	April 27, '83	
Lawe, Henry	Ottawa, Ont.	Feb. 28, '38	April 14, '72	O. L. S., M. L. S., Topographical Surv. Branch Dept. of Interior.
Lemoine, Charles Errol	Ville Montcalme, P. Q.		Mar. 31, '82	Q. L. S.
Lendrum, Robert Watt	Strathcona, Alta.	July 24, '34	May 15, '80	O. L. S.
Lighthall, Abram	Vancouver, B. C.	Mar. 30, '78	Dec. 25, '09	
Lindsay, James Herbert	Regina, Sask.	Nov. 27, '82	May 18, '11	
Lonergan, Gerald Joseph	Buckingham, P. Q.	Oct. 8, '71	Feb. 28, '01	Q.L.S., Insp. of Surveys Dept. of Interior.
Loucks, Roy Wm. Egbert	Saskatoon, Sask.	Oct. 31, '84	Mar. 1, '12	
Lumsden, Hugh David	Ottawa, Ont.	Sept. 7, '44	April 14, 72	O. L. S.
MacLennan, Alexander L	Toronto, Ont.	May 10, '78	Feb. 23, '05	
MacPherson, Charles Wilfrid	Dawson, Y. T.	Sept. 6, '71	Mar. 7, '00	O. L. S.

APPENDIX No. 10.—*Continued.*

List of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Magrath, Charles Alexander...	Ottawa, Ont..... ..	April 22, '60	Nov. 16, '81	B. A. Sc., O.L.S., B.C.L.S., D. T. S., Member International Waterways Commission.
Martindale. Ernest Smith.....	Kingsmill, Ont.....	May 20, '86	Mar. 11, '11	
Martyn, Oscar William	Mitchell, Ont	Dec. 2, '88	Mar. 11, '11	
Matheson, Hugh..... ..	Ottawa, Ont..... .	May 2, '79	May 9, '11	
Meadows, William Walter	Maple Creek, Sask..	May 27, '73	Feb. 23, '05	O. L. S.
Miles, Charles Falconer.... ...	Toronto, Ont.....	Jan. 30, '38	Apr. 14, '72	O.L.S. Inspector of Surveys, Dept. of Interior.
Mitchell, Benjamin Foster	Calgary, Alta	June 16, '80	April 16, '08	A. L. S.
Moberly, Harford Kenneth. ..	Moosomin, Sask.....	——	'69 April 21, '03	
Molloy, John..... ...	Winnipeg, Man. ...	Jan. 13, '40	April 14, '72	M. L. S.
Montgomery, Royal Harp.....	Prince Albert, Sask	May 20, '82	Feb. 23, '05	O. L. S.
Moore, Herbert Harrison.....	Calgary, Alta.... ..	Dec. 1, '69	Feb. 17, '04	
Morrier, Joseph Eldedge.....	Prince Albert, Sask.	Aug. 29, '74	May 16, '07	
McArthur, James Joseph.. ...	Ottawa, Ont.	May 9, '56	April 17, '79	Boundary Survey, Dept. of Interior.
McCaw, Robert Daniel.....	Sidney, B. C.....	May 21, '83	Mar. 23, '09	
McColl, Gilbert Beebe.....	Winnipeg, Man.....	Oct. 8, '82	Mar. 20, '07	M.L.S., D.T.S.
McColl, Samuel Ebenezer	Winnipeg, Man. ...	July 17, '86	May 18, '11	
McDiarmid, Stuart Stanley....	Vancouver, B. C....	Aug. 4, '81	Feb. 23, '05	B.C.L.S.
McEwen, Duncan Findlay.....	Edmonton, Alta....	Aug. 7, '73	May 18, '11	
McFadden, Moses.	Vancouver, B. C....	Aug. 26, '26	April 14, '72	O.L.S., M.L.S.
McFarlane, Walter Graham ...	Toronto, Ont.	Sept. 28, '75	May 19, '05	
McFarlane, John Baird.....	Toronto, Ont.	Feb. 25, '79	June 3, '08	
McFee, Angus.....	Red Deer, Alta. ...	July 14, '46	April 19, '79	
McGeorge, William Graham. ..	Chatham, Ont.....	Mar. 22, '87	Mar. 21, '10	
McGrandle, Hugh..... ...	Wetaskiwin, Alta...	Mar. 12, '57	Mar. 30, '83	O.L.S.
McKenzie, John.....	New Westminster, B. C....	Oct. 31, '47	Nov. 18, '87	
McLean, James Keachie.....	Ottawa, Ont.....	Dec. 19, '51	April 1, '82	O.L.S. Dept. of Indian Affairs.
McMaster, William Angus Alexander.....	Palmerston, Ont....	Feb. 1, '85	July 6, '10	
McMillan, George.	Finch, Ont.	Dec. 9, '69	Feb. 22, '06	
McNaughton, Alexander L....	Cornwall, Ont.....	Sept. 30, '81	Feb. 23, '05	O.L.S., B.C.L.S.
McPherson, Archibald John. ..	Regina, Sask.	——	'70 Feb. 21, '01	
McPhillips, George.....	Winnipeg, Man.....	April 26, '48	June 17, '75	O.L.S., M.L.S.
McPhillips, Robert Charles	Winnipeg, Man.....	April 24, '56	May 17, '80	
McVittie, Archibald W.....	Victoria, B.C.....	May 5, '58	Mar. 30, '82	B.C.L.S.
Nash, Thomas Sanford.....	Ottawa, Ont.....	July 2, '75	Feb. 18, '01	Topographical Surveys Branch, Dept. of Inter.
Neville, Everett A.....	Ruthven, Ont.....	Jan. 8, '87	May 18, '11	
Ogilvie, William	Ottawa, Ont.....	April 7, '46	April 14, '72	O.L.S.
O'Hara, Walter Francis..	Ottawa, Ont	... ...	Feb. 19, '95	O.L.S.
Ord, Lewis Redman.....	Hamilton, Ont.....	Oct 17, '56	April 1, '82	O.L.S.
Palmer, Philip Ebenezer.....	Dorchester, N.B....	Mar. 6, '88	Mar. 7, '12	
Parsons, Johnstone Lindsay R..	Regina, Sask.	Jan. 18, '76	Feb. 23, '05	O.L.S.
Patrick, Allan Poyntz.....	Calgary, Alta.....	July 18, '49	Nov. 19, '77	B.C.L.S., D.T.S.
Patten, Thaddeus James.....	Little Current, Ont..	Feb. 4, '50	Mar. 29, '83	O.L.S.
Pearce, William.....	Calgary, Alta	Feb. 1, '48	May 10, '80	O.L.S., B.C.L.S.
Pearce, Seabury Kains.....	Calgary, Alta.....	Dec. 6, '67	Mar. 9, '11	
Pequegnat, Marcel	Berlin, Ont.....	April 27, '86	June 6, '10	
Peters, Frederic Hatheway .. .	Calgary, Alta.....	Nov. 4, '83	Mar. 4, '10	Commiss'er of Irrigation.
Phillips, Edward Horace. ...	Saskatoon Sask.....	Dec. 19, '78	Feb. 24, '02	
Phillips, Harold Geoffrey.....	Saskatoon, Sask.....	Sept. 3, '87	April 23, '10	
Pierce, John Wesley	Ottawa, Ont.....	... ...	Dec. 24, '09	
Plunkett, Thomas Hartley.....	Meaford, Ont	June 1, '78	Mar. 12, '08	
Ponton, Archibald William....	Edmonton, Alta....	Jan. 25, '59	May 18, '81	O.L.S.
Powell, William Henry.....	Vancouver, B.C....	Dec. 22, '84	Feb. 22, '11	
Proudfoot, Hume Blake	Saskatoon, Sask....	June 23, '58	Mar. 28, '82	O.L.S.
Purser, Ralph Clinton.....	Windsor, Ont..... .	April 7, '86	Feb. 2, '11	

APPENDIX No. 10.—*Continued.*

List of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Rainboth, Edward Joseph	Ottawa, Ont.		May 19, '81	Q.L.S., O.L.S.
Ransom, John Thomas	Toronto, Ont.	Aug. 24, '88	Jan. 14, '11	
Reilly, William Robinson	Regina, Sask.	Aug. 10, '57	Nov. 17, '81	O.L.S., M.L.S.
Richard, Joseph Francois	Ste. Anne de la Pocatiere, P.Q.		May 13, '82	
Rinfret, Claude	Montreal, P.Q.	Jan. 5, '86	Mar. 20, '08	Q.L.S.
Rinfret, Raoul	Montreal, P.Q.	July 16, '56	Feb. 20, '00	Q.L.S.
Ritchie, Joseph Frederick	Prince Rupert, B.C.	May 23, '63	Jan. 7, '89	B.C.L.S.
Robertson, Henry H.	N. Timiskaming, P.Q.	Sept. 13, '47	April 14, '72	Q.L.S.
Roberts, Sydney Archibald	Victoria, B.C.	April 10, '48	May 16, '85	B.C.L.S.
Roberts, Vaughan Maurice	Goderich, Ont.	Mar. 22, '64	May 17, '86	
Robinson, Ernest Walter P.	Ottawa, Ont.	May 8, '80	May 1, '08	
Robinson, Franklin Joseph.	Regina, Sask.	Oct. 20, '70	Feb. 20, '00	Deputy Minister of Public Works.
Rolfson, Orville	Walkerville, Ont.	Feb. 26, '85	July 11, '08	
Rombough, Marshall Bedwell	Morden, Man.	Oct. 14, '35	April 14, '72	M.L.S.
Rorke, Louis Valentine	Toronto, Ont.	Feb. — '65	Aug. 13, '91	O.L.S. Inspector of Surveys for Ontario.
Ross, George	Welland, Ont.	June 12, '53	Nov. 21, '82	O.L.S.
Ross, Joseph Edmund	Kamloops, B.C.	Jan. 9, '61	Feb. 12, '91	O.L.S., B.C.L.S.
Routly, Herbert Thomas	Haileybury, Ont.	Jan. 20, '78	Feb. 15, '11	
Roy, George Peter	Quebec, P.Q.	Oct. 1, '52	Nov. 17, '81	Q.L.S.
Roy, Joseph George Emile	Quebec, P.Q.	Mar. 14, '86	May 25, '10	
Saint Cyr, Jean Baptiste	Montreal, P.Q.	Dec. 17, 66	Feb. 17, '87	Q.L.S.
Saint Cyr, Arthur.	Ottawa, Ont.	Nov. — '60	Feb. 17, '87	
Saunders, Bryce Johnston	Edmonton, Alta.	Oct. 17, '60	Nov. 16, '84	O.L.S.
Scott, Walter Alexander	Galt, Ont.	Aug. 8, '85	Mar. 9, '09	
Seager, Edmund	Kenora, Ont.	Nov. 22, '38	April 14, '72	O.L.S.
Sewell, Henry DeQuincy	Toronto, Ont.	April 18, '48	May 16, '85	O.L.S.
Seymour, Horace Llewellyn	Edmonton, Alta.	June 11, '82	Feb. 22, '06	O.L.S.
Shaw, Charles Aeneas	Greenwood, B.C.	Nov. 16, '53	May 10, '80	O.L.S., B.C.L.S.
Shepley, Joseph Drummond	N. Battleford, Sask.	Sept. 13, '79	Mar. 12, '06	
Smith, Charles Campbell	Ottawa, Ont.	Jan. 1, '73	Feb. 22, '06	O.L.S.
Smith, Donald Alpine	Claude, Ont.	Sept. 22, '80	April 21, '10	
Smith, James Herbert	Edmonton, Alta.	Nov. 9, '76	Feb. 23, '05	
Soars, Henry Martin Robinson	Edmonton, Alta.	April 22, '77	Nov. 2, '08	
Speight, Thomas Bailey	Toronto, Ont.	Feb. 8, '59	Nov. 16, '82	O.L.S.
Starkey, Samuel M.	Codys, N.B.	Sept. 4, '37	April 14, '72	
Steele, Ira John	Ottawa, Ont.	April 6, '81	April 16, '08	
Stewart, Elihu	Collingwood, Ont.	Nov. 17, '44	April 14, '72	O.L.S.
Stewart, Lionel Douglas N	Collingwood, Ont.		Jan. 27, '10	
Stewart, Will Malcolm	Saskatoon, Sask.	Nov. 26, '84	June 6, '07	
Stewart, Louis Beaufort	Toronto, Ont.	Jan. 27, '61	Nov. 22, '82	O.L.S., D.T.S. Professor of Surveying and Geodesy, University of Toronto.
Stewart, Alexander George	Ottawa	Aug. 16, '87	Mar. 14, '10	
Stewart, George Alexander			April 14, '72	O.L.S.
Stock, James Joseph	Ottawa, Ont.	Aug. 16, '87	Mar. 2, '10	
Street, Paul Bishop	Toronto, Ont.	Dec. 3, '81	Mar. 29, '10	
Stuart, Alexander Graham	Buckingham, P.Q.	July 16, '88	May 9, '11	
Summers, Gordon Foster	Haileybury, Ont.		Oct. 20, '10	
Taggart, Charles Henry	Ottawa, Ont.	'83	May 9, '11	
Talbot, Albert Charles	Calgary, Alta.	April 5, '56	May 13, '80	
Taylor Alexander	Portage la Prairie, Man.	Aug. 6, '75	June 9, '04	M.L.S.
Taylor, William Emerson	Owen Sound, Ont.	Aug. 3, '81	Dec. 16, '10	
Teasdale, Charles Montgomery	Concord, Ont.	Oct. 18, '79	Mar. 9, '06	
Thompson, William Thomas	Grenfell, Sask.	Nov. 1, '53	Nov. 19, '77	D.T.S.
Tipper, George Adrian	Brantford, Ont.	July 25, '86	May 18, '11	
Tracy, Thomas Henry	Vancouver, B.C.	June 25, '48	April 14, '72	O.L.S., B.C.L.S.
Tremblay, Alfred Joseph	Les Eboulements, P.Q.		Feb. 18, '90	

APPENDIX No. 10.—*Continued.*

List of Dominion Land Surveyors who have been supplied with Standard Measures—*Continued.*

Name.	Address.	Date of birth.	Date of Appointment or of Commission.	Remarks.
Tremblay, Albert Jacques	Edmonton, Alta	July 25, '87	Mar. 1, '12	
Turnbull, Thomas	Winnipeg, Man	May 26, '57	Mar 29, '82	O.L.S.
Tyrrell, James William	Hamilton, Ont	May 10, '63	Feb. 16, '87	O L.S.
Underwood, Joseph Edwin	Saskatoon, Sask	Nov. 3, '82	May 18, '11	
Vaughan, Josephus Wyatt	Vancouver, B C	Oct. 17, '45	June 11, '78	B.C.L.S.
Vicars, John Richard Odlum	Kamloops, B.C.	April 16, '55	May 17, '86	O.L.S., B.C.L S.
Waddell, William Henry	Edmonton, Alta	Mar. 23, '83	Mar. 25, '07	O.L.S.
Waldron, John	Moosejaw, Sask	Aug. 1, '72	April 2, '07	
Walker, Claude Melville	Guelph, Ont	Oct. 16, '84	Mar. 11, '11	
Wallace, James Nevin	Calgary, Alta	Aug. 21, '70	Feb. 20, '00	O.L.S.
Warren, James	Walkerton, Ont.	Nov. 7, '37	April 14, '72	
Watt, George Herbert	Ottawa, Ont	Feb. 5, '76	Feb. 24, '02	
Weekes, Abel Seneca	Edmonton, Alta	Feb. 17, '66	Feb. 11, '92	
Weekes, Melville Bell	Regina, Sask	Nov. 28, '74	Feb. 18, '03	O.L.S.
Wheeler, Arthur Oliver	Sidney, B.C	May 1, '60	Nov. 21, '82	O.L.S., B.C.L.S.
White-Fraser, George W.R.M	Ottawa, Ont	— —	'61 Feb. 21, '88	D.T.S.
Wiggins, Thomas Henry	Saskatoon, Sask.	Aug. 24, '63	Feb. 18, '96	O.L.S.
Wilkins, Frederick W. B.	Norwood, Ont	June 27, '54	May 18, '81	O.L.S., D.T.S.
Wilkinson, William Downing	Not known		Feb. 22, '93	
Williams, Guy Lorne	Enderby, B.C	Mar. 3, '79	June 24, '08	B.C.L.S.
Wilson, Reginald Palliser	Winnipeg, Man	July 9, '72	Jan. 26, '11	M.L S.
Woods, Joseph Edward	Pincher Creek, Alta	Oct. 13, '61	Nov. 14, '85	
Young, Walter Beatty	Winnipeg, Man	July 6, '80	Mar. 25, '05	M.L.S.
Young, William Howard	Lethbridge, Alta	June 8, '78	May 17, '07	

REPORTS OF SURVEYORS

SESSIONAL PAPER No. 25b

GENERAL REPORTS OF SURVEYORS

1911-1912

APPENDIX No. 11.

ABSTRACT OF THE REPORT OF J. R. AKINS, D.L.S.

SURVEY OF THE NORTH BOUNDARY OF THE PEACE RIVER BLOCK.

We left Edmonton on March 1 with four pack ponies to a sleigh, each sleigh being loaded with about twenty-five hundred pounds. A team of heavy horses was purchased at Athabaska Landing to assist the pack ponies in rough places, and many times they proved indispensable. Dunvegan was reached on March 23, but the ice was then considered unsafe and the freighters would not risk their horses on it. It was accordingly decided to take the overland route. For a distance of about twenty-five miles north of Dunvegan the country is nearly open, and the ground was almost bare of snow, but north of that in the woods the snow was very deep. The weather again turned cold, and a crust formed on the snow so hard that some of the freighters refused to go farther and accordingly went back. On April 15 it turned warm and wagons had to be used for transport in the open and sleighs in the bush. Boundary lake was reached on April 28, and the following day search was made for the old monuments on the twenty-second base which was the initial point of our survey. These monuments, though placed there twenty-eight years ago, were found with little difficulty, and the east outlines of townships 85, 86, 87 and 88 were run north to the twenty-third base line, which is the north boundary of the Peace River block at the northeast corner.

The survey of the north boundary of the block was begun on May 29, and notwithstanding the extremely wet weather the northwest corner of the block was reached on September 23, a distance of one hundred and two miles being run, mostly through wooded country and heavy timber.

On reaching the northwest corner of the block I learned that Mr. L. Brenot, D.L.S., required assistance to enable him to complete the survey of the west boundary before the cold weather would set in, so we moved south to meet him and the two parties completed the west boundary on October 12.

I then moved to the northeast corner of the block and produced the twenty-third base easterly. The line runs along the top of the Clear hills for about thirty miles, and because no horse feed grows on these hills much difficulty was experienced in transportation. The last camp on the line was supplied by man-packing, so that after completing twenty-two miles we were compelled to quit work as the nearest horse feed (which was only frozen grass) was ten miles from the base line.

A sleigh road was made from the Fort St. John trail to the Clear hills to intersect the base line and a cache was built to store the supplies which we left. As the snow was getting deep and the rivers frozen, we closed operations and left for Edmonton arriving there on January 7.

The portion of the Peace River block lying north of Peace river has splendid soil, and though the season is short, the growth is rapid and very luxuriant. About twenty-five per cent. of the country is open, the open part lying chiefly along Peace and Pine rivers. Grass and pea-vine grow in abundance. Although the Indians put up no hay for their horses, allowing them to run all winter, a rancher would have to put up feed for his stock for at least three months in the year and sometimes longer. Hay can be obtained in the flats and good feed can be got by cutting the grass on the uplands.

The climate along the north boundary of the block is not suitable for grain growing. This is no doubt due to the many muskegs through which the line runs and the large ones in close proximity to the line, as nearer the river the climate is very different, and at Fort St. John vegetables are grown successfully.

Considerable timber grows in the northeast part of the block but the quality is not first class, being composed of spruce, poplar, and jackpine. A large quantity of pulp-wood could be obtained.

The only mineral seen was outcrops of coal on Doig river. Sandstone suitable for building purposes was found on Pine and Doig rivers.

Game is rather scarce north of Pine river as it is hunted by the Beaver Indians, but moose, bears, and caribou are to be found. Grouse of several varieties are very plentiful and the streams contain many kinds of fish including grayling and different kinds of trout.



Photo.—J. R. Akers, D.L.S.

Looking East on the Twenty Third Base Line, Range Fourteen, West of the Sixth Meridian.

APPENDIX No. 12.

ABSTRACT OF THE REPORT OF C. F. AYLSWORTH, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA AND SOUTHERN SASKATCHEWAN.

My first work of the season was the survey of a summer resort on Arbor island in Max lake, which is situated in township 1, range 20, west of the principal meridian in the Turtle Mountain forest reserve. The surface of the island is undulating and is about ten feet above the water of the lake. The beach is sandy while the lake abounds with all kinds of fish. A good road leads to the lake from Boissevain in township 3, range 20. An old-settled agricultural district lies between Boissevain and Max lake. Wheat raising is the principal industry followed in this district but there is sufficient mixed farming to meet the domestic demand. The prosperity of the district is shown by the good farm buildings, churches, schools and roads.

The forest growth in the Turtle Mountain reserve is greatly retarded by the fires which sweep over it. These fires get beyond control of the fire rangers and destroy not only the growing timber, but also the alluvial soil on the surface, thus retarding future vegetation.

Having completed the subdivision at Max lake, we left on May 24 for Moose mountain where our next work lay, passing through Deloraine, Napinka, Redvers and Cannington Manor. We found good roads all the way. The districts around Deloraine and Napinka are among the oldest settled portions of Manitoba and possess soil of the best fertility. From Napinka to Cannington Manor, settlement is of more recent date, but it is improving rapidly. From Cannington Manor to Fish lake there are good roads during dry seasons, but they are hilly, and during wet seasons are very heavy.

We reached Fish lake on section 15, township 10, range 3 west of the second meridian on June 1 and performed the subdivision surveys required in several summer resorts surrounding the lake. Fire has not done any damage in the Moose Mountain forest reserve in which this lake is situated, and the timber and scrub are all growing luxuriantly. There are roads through the mountains leading to Fish lake from Old Cannington Manor, Carlyle and Areola. Fish lake is a fairly large body of water surrounded by sandy beaches and contains many varieties of fish.

Having finished the surveys at Fish lake on July 13 we left the following day for Tyndall to retrace the east and south boundaries of St. Peter's Indian reserve across townships 13, 14, and 15, range 6, east of the principal meridian. On section 10 of township 13 is the Garson limestone quarry which employs about 100 men. The surface stone throughout this township is limestone and the land, though hard to clear of stones, is very productive, growing heavy crops of wheat, oats and vegetables. In townships 14 and 15 the land is somewhat lower, but the soil is of a superior quality.

This work having been completed we closed our survey operations for the season on November 21.

APPENDIX No. 13.

ABSTRACT OF THE REPORT OF P. R. A. BELANGER, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION OF CONTRACTS IN MANITOBA AND SASKATCHEWAN.

After organizing my party at Winnipeg I proceeded to Pointe-du-Bois whence we travelled up Winnipeg river, partly on the ice and partly by boat, arriving at the the place of my first work on April 20, 1911.

The surveys to be made here consisted of subdivision and traverses in township 16, range 16, and townships 15 and 16, range 17, east of the principal meridian.

The country covered by these surveys may be described as a rough, rocky, timbered country broken by tamarack and spruce swamps and numerous lakes. Some good farming land, however, can be found in scattered pieces along Winnipeg river, principally along the south bank in range 16, in a timber limit. Some of the islands would also make fine farms, but the whole is heavily timbered.

Large game, and fish such as pike, pickerel and sturgeon, are abundant.

Winnipeg river averages from thirty to fifty chains in width and is very deep. It affords the only practicable route for transportation across the country, and, from Pointe-du-Bois where it has been dammed, now forms a smooth sheet of water over forty feet deep, extending about nine miles northeast to Lamprey falls which, owing to the effect of the dam, have entirely disappeared. From there easterly, with the exception of three or four short stretches of swift water, the current is slow and the river is easily ascended with canoes or rowboats up to the Ontario boundary. Since the building of the dam a moderate-sized boat may run from Pointe-du-Bois right to the Ontario boundary.

At present this country may be reached by travelling from Winnipeg to Lac-du-Bonnet via the Canadian Pacific railway, from there to Pointe-du-Bois via the Winnipeg City Power railway, and thence by boat up the river. It may also be reached from Kenora travelling by boat down the river, but this route is unsuitable, as several portages have to be made to avoid dangerous falls and rapids.

Lumber is still the chief asset of this district. A large percentage of the timber has already been destroyed by fires, but what is left is suitable for all purposes, from first-class lumber to ties, posts and poles, there being also an abundance of pulp-wood and cord-wood. This timber is all in close proximity to the banks of the river, or is on islands and therefore easily accessible.

I found numerous traces of mica on the river banks which, for the most part, are rocky, and also in the interior three miles north of the river, but did not come across any large veins.

The city of Winnipeg has now finished the construction of an immense power plant by the damming of Pointe-du-Bois falls and has developed energy amounting to over 100,000 horse-power.

From Pointe-du-Bois I proceeded *via* Winnipeg to Oak Point settlement where I secured my horses and drove to my second work at Fisher River settlement. The work here consisted of the inspection of Mr. Tyrrell's contract No. 2 of 1910 and the survey of a small settlement called Fisher Bay.

This settlement is situated on the west shore of Fisher bay, from which it derives its name, and the bay itself forms part of lake Winnipeg. The settlement is very small and comprises only ten lots which are all occupied by half-breed fishermen coming from Fort Churchill, Oxford House, Norway House and Cross lake. The land they occupy is very good for mixed farming but, with the exception of marshes at the

western end of the settlement and small cleared openings near the shore of the lake, it is heavily timbered. Fisher Bay settlement is accessible by boat from all points on lake Winnipeg. There is also a wagon road which leads to Fisher river, and from there roads lead south, east and west. These roads, however, need to be greatly improved before there can be any heavy traffic over them.

From Fisher Bay I drove to Oak Point settlement through the new St. Peter's Indian reserve on Fisher river, and through numerous settlements. All along the way I was agreeably surprised to see the wonderful change that has taken place since my last trip through that country in 1910. There are still, however, large tracts of vacant land in the vicinity of Island lake where cattle raising and dairying could be profitably carried on.

My next work was the inspection of survey contracts east of Prince Albert. I first examined Mr. Teasdale's contract covering townships 44 to 48, range 11, west of second meridian. I reached this work by following a lumber road from the railway siding to the lumber camp, situated near the north boundary of township 45, and from there by an old pack-trail as far as the centre of township 46, but farther north pack-horses had to be used. A wagon road can be easily made along this pack-trail, which, in this range, leads in a northerly direction to Carrot river near the north boundary of township 48. The country covered by this contract is generally rolling and, with little exception, is heavily timbered, part of the timber being included in the timber berth covering the north half of township 45 and the south half of township 46. The land is first class, but it needs to be cleared before it can be settled.

Returning to Peesane I proceeded southerly from the railway siding to Mr. Ransom's contract No. 5 of 1911, covering townships 39 and 40, ranges 4, 5, 6 and 7, west of the second meridian, but inspected only a portion of it as the whole contract was not completed.

My next work was the inspection of Mr. Stewart's contract No. 8 of 1911, situated north of Carrot river, in range 11. To reach this work I went north to Tisdale, a thriving town on the Canadian Northern railway, and from there followed the main road passing through Forester, New Osgoode, and Arborfield. The two first-named places are thickly settled; the last-named one is comparatively new, though very promising, and as soon as the land is opened, this settlement will compare favourably with the others. The land is first class but the great drawback to all these settlements is the want of a sufficient number of machines to thresh the grain; this shortage proved ruinous to numerous farmers whose grain was not yet threshed in December and was under snow for the winter.

Leaving Arborfield I followed Carrot river for a few miles to Mr. Stewart's contract comprising townships 49 to 53, range 11. The surface of these townships is flat and covered with a thick growth of small poplar and willow which keeps it wet. The only trail in the interior of the townships is the surveyors' trail which leads northerly to Saskatchewan river.

Large game, such as moose and deer, is very plentiful, while partridges and prairie-chickens are also abundant in the whole district. No minerals of any kind were found.

Having completed the inspection of all the contract surveys in the Carrot river district that were ready for inspection, I returned to Tisdale and, on December 2, left for Gypsumville, reaching there on the 6th. Here my work consisted of the inspection of Mr. Pequegnat's contract No. 3 of 1911 and the performance of some retracement and resurvey work in townships 31 and 32, range 9, and township 33, range 8, west of the principal meridian.

The country covered by this contract is for the greater part unfit for settlement at the present time, though some good homesteads suitable for mixed farming are found. The chief drawback is the lack of roads, but besides this inconvenience the land is heavily covered with bush of different kinds. On the other hand, the fact

that Gypsumville lies in township 32, range 9, and is the present terminus of the Oak Point branch of the Canadian Northern railway, where the famous gypsum mines are worked to so much advantage, should be an inducement to settlers to seek land in that direction.

It is hardly credible that similar country crossed by the railway from Oak Point to Gypsumville, which only a few years was considered chiefly unfit for settlement, is now mostly settled and has thriving villages at every station along the line.

Gypsumville is still only a small village composed of a first-class general store where the post-office is kept, a boarding house and a few houses, all owned by the Gypsum company who use them for their employees. It is situated within twenty chains of the mines in section 26, township 32, range 9.

Gypsum is also found at a short distance east and southeast of Gypsum lake in township 33, range 8, but the mine has not been worked yet. Good spruce timber is available in township 33, range 8, and the lumber intending settlers may require will be easily obtained here. This township is reached by the road from lake St. Martin from which there is also a road leading to Gypsumville.

APPENDIX No. 14.

ABSTRACT OF THE REPORT OF G. A. BENNETT, D.L.S.

MISCELLANEOUS SURVEYS IN SASKATCHEWAN AND ALBERTA.

My first work was the survey of the dry bed of a lake in township 10, range 11, west of the second meridian, the dry bed of Grassy lake in townships 9 and 10, ranges 10 and 11, and the bed of a lake nearly dry in township 9, range 10. The settlers in this district are progressive and prosperous. Large farm buildings and handsome houses have replaced the sod stable and shack while six-horse teams or traction engines are used for breaking the land. Hay was formerly obtained from the dry lake beds, but these are rapidly being cultivated and are found to produce excellent crops of wheat and flax. Drinking water is scarce and small towns find difficulty in procuring an adequate supply of good quality.

I next retraced some lines in townships 10 and 11, range 19, in townships 7 and 8, range 15, and in township 8, range 16. I also placed monuments defining the west boundary of township 20, range 17, along Indian reserve No. 75. This latter district is partly covered by bluffs of poplar and willow. Although the land was homesteaded many years ago little effort has been made to increase the small natural patches of prairie. The area of cultivated land, is therefore, somewhat limited but as no damage results from hail or frosts, a fair living is made by the farmers.

On June 24 I began the traversing of the right bank of South Saskatchewan river and the resurvey of lands along the river in township 25, range 5, and township 19, range 15, west of the third meridian. This resurvey proved so extensive, as no monument of the original survey could be found near the river, that the work was not entirely completed. The land in the valley will not prove valuable wheat land but vegetables and small fruits grow well. Irrigation will be necessary to obtain the best results but water for this purpose is easily obtained from the small streams flowing into the river.

A retracement survey in township 13, range 4, and a verification survey of islands in Johnston lake was the next work, and on August 15, I began the examination of the survey of townships 13 and 16, range 14, and township 16, range 13, in which large errors in the original survey were found.

From there I proceeded to Rosetown *via* Saskatchewan Landing and retraced erroneous lines in township 19, range 15, and township 26, range 20. Dry lake beds were resurveyed in townships 27 and 28, ranges 14 and 15, township 26, range 23, and township 33, range 26.

This tract of apparently semi-desert known as 'the great plains' has become the home of thousands of progressive and enterprising farmers. Grain growing is carried on extensively, and breaking at the rate of thirty acres per day, is being done with gasoline traction engines. Some idea of the extensive scale on which operations are being carried on may be gathered from the fact that one farmer ordered thirty new binders to harvest his crop this year.

Surveys of dry lake beds were also made in township 11, range 4, townships 14 and 15, ranges 3 and 4, and township 18, range 26. Partially dry lake beds were also surveyed in townships 14 and 15, range 10, and township 18, range 26. A traverse was made of Ghost Pine lake in townships 36, ranges 24 and 25, all west of the fourth meridian.

The probable factor affecting the variation of the level of the lakes appears to be the increase or decrease of the permeability of the surrounding soil in the depressions. It was observed that when large areas were plowed up near the lake basin the volume of water was much lessened. Fire also is an active agent as it destroys the impervious layer of peaty matter found in the lake bottoms whenever the lake becomes sufficiently dry. Lakes in the prairie were found drying up, while lakes in the bush country were larger than when originally surveyed.

Erroneous lines were retraced in township 21, range 1, townships 10 and 11, range 5, townships 10, ranges 6 and 10, and township 8, range 21. A traverse of Little Bow river was made in township 14, range 21, all west of the fourth meridian.

The surveying season was unusually cold and wet. Frost occurred on August 25 and the continued wet weather rendered threshing so difficult that on December 11, the date of closing survey operations, thousands of acres of grain on the prairie were still in the stook.



Pack Train along Pine River—Peace River Block.

Photo by J. R. Akins, D.L.S

APPENDIX No. 15.

ABSTRACT OF THE REPORT OF G. H. BLANCHET, D.L.S.

SURVEY OF THE TWENTY-THIRD BASE BETWEEN THE FOURTH AND FIFTH MERIDIANS.

The starting point of our work was reached by sending the horses along the trail close to the fourth meridian, while the men and supplies went in scows on Athabaska river to McMurray and thence by Clearwater river to the fourth meridian.

Camp was pitched on June 10, 1911, three miles west of the fourth meridian, and, after turning off the base line and checking our starting point, the production of the line westerly was begun on June 17.

Through the first nine ranges the line follows very closely Clearwater river the general course of which is westerly. The valley of this river has an average depth of about six hundred feet and is from two to three miles in width.

The northeast corner of section 36, township 88, range 1, is seventeen chains south of the top of the Clearwater valley. The valley here was formerly heavily timbered with spruce, balsam, birch and poplar. Much of this timber, however, has been destroyed by frequent fires which have swept most of the country back of the river valley.

For a distance varying from a few chains to several miles back from the river valley the country consists of fairly well-drained poplar and jackpine ridges and spruce swamp, but in general on both sides of the river beyond the direct drainage area afforded by it and its tributary streams the country is principally muskeg containing patches of jackpine and broken by occasional poplar ridges.

The base line runs into the valley on the north boundaries of section 34 and 35, range 1, the valley here containing some excellent spruce. It also passed within three-quarters of a mile of the Whitemud falls on Clearwater river in the northwest quarter of section 2, range 1. These falls are admirably situated for the development of power, being capable of producing about 3,500 horse-power.

Gypsy creek flows in a northwesterly direction across township 88, range 1, crossing the base line on the north boundary of section 31, where it has a considerable valley. Some good spruce is to be found along this valley while on either side are poplar and jackpine ridges.

Limestone outcrops in many places along this portion of Clearwater river render navigation impossible. The Cascade rapids occur about one mile north of the northeast corner of section 32, township 88, range 2. They form the head of navigation on Clearwater river. Below this point boats with a draught of four feet could find sufficient water if carefully navigated among the numerous sand-bars. A brief description of this river might be given here. The distance from its juncture with the Athabaska at McMurray to the Cascades corresponds to forty-seven miles by the base line and is probably sixty-five miles by the river. It discharges about five thousand cubic feet a second till joined by Christina river from the south in range 7. This increases its volume by about one-half. The current averages two and one-half miles an hour and the width of the river varies from six to twelve chains. Numerous islands, generally timbered, occur. The banks are about twelve feet high, being sufficient probably to prevent flooding on the flats. The valley is almost everywhere heavily wooded with spruce, poplar and birch, with a dense underbrush.

Mineral springs, chiefly salt and sulphur, occur in many places along the river. These indications of salt were confirmed at the oil prospect near McMurray where in boring they found a bed of salt several hundred feet thick. Salt marshes, some of considerable extent, occur along the river valley.

In range 2 the base line passes through a mixed country of poplar and jackpine, with muskeg to the south.

Edwin creek, flowing through a deep wooded valley, crosses the line on the north boundary of section 34, range 3. This stream has its source in the muskegs in township 87, range 1, and flows northwesterly, being joined by many small feeders, the whole forming an excellent drainage system for the country adjacent to it. Several salt springs were noticed in its valley and a very strong sulphur spring is located at its mouth.

The Highhill river flows into the Clearwater from the north in the westerly side of range 3. It is about sixty feet wide and has a fair flow of water, but is too much broken by rapids for ordinary navigation.

In range 4 the line runs through an extensive muskeg, a bay of which approaches the banks of the Clearwater on the north. To the southwest this muskeg extends almost to Christina river, while to the south and southeast it includes the swampy tract occupied by Gordon and Gypsy lakes. Most of this country may be made suitable for agriculture by drainage. The chief hindrance to natural drainage is the surface moss through which water percolates very slowly even on a considerable slope. At the same time this is one of Nature's best provisions for the conservation of moisture. This feature is noted throughout the north where in many cases the divide between two rivers is a muskeg, the seepage from which feeds the tributary streams of both rivers.

In range 5 the line runs down to Clearwater river following the valley of Cottonwood creek and crossing several salt marshes near the river. Exposures of tar sand and outcrops of impure lignite were observed here.

Through ranges 6, 7, 8 and 9, the line followed the river fairly closely. It was decided, therefore, to send the horses to McMurray and move camp by scow. This necessitated considerable hard climbing but was otherwise satisfactory and gave the horses a good rest and splendid feeding ground, the benefit of which was felt in the heavy work of the fall and winter.

The weather in the latter part of July and nearly all through August and September was very unsettled, scarcely a day passing without rain. This was unfortunate not only on account of the discomfort and delays caused, but the excessive precipitation kept the creeks and muskegs at very high water till freeze-up, making trail location very difficult. Besides, as the rainy season extended through the haying time it was almost impossible to put up hay.

In range 7 Christina river flows into the Clearwater from the south. It is a considerable stream having a flow of about two thousand cubic feet a second. Its course is too much broken by rapids for ordinary navigation although small scows can be tracked up. Its basin which extends to the south for over seventy-five miles is separated from that of the Athabaska by the Little Rocky mountains. An extensive burned area runs southwest from the mouth of Christina river, patches of prairie some several hundred acres in extent having been formed by these fires.

The soil in the Clearwater valley is almost everywhere good, the subsoil varying from clay to clay loam and sandy clay with a surface of from two to ten inches of black loam. It is for the most part heavily timbered, spruce predominating on the river flats and poplar on the higher slopes of the valley. The large timber and heavy underbrush should indicate good growing conditions.

On the north side of the Clearwater, near its mouth, the country back from the valley becomes higher and drier, good patches of spruce and jackpine being found far back from the river.

Between the Christina and Athabaska rivers the country is drained by two fairly large streams, Hangingstone creek and Cameron creek (formerly known as Horse creek). As these streams and their tributaries have deep valleys the country here is rough. It is for the most part covered with a well grown second-growth poplar.

McMurray settlement is situated at the juncture of the Clearwater and Athabaska rivers in range 9, being about three miles north of the base line. This was an important post in the early Hudson's Bay days before the railway. Situated at the juncture of the two principal trade routes it naturally became the receiving depot for furs and the distributing point from which supplies brought here by the long water route from Winnipeg were sent to the various posts throughout the north. With the building of the Canadian Pacific railway the Winnipeg-McMurray water route was abandoned in favour of Edmonton and the Athabaska, and since then the importance of McMurray in the fur trade has been small, except as the head of steamboat navigation on the lower Athabaska. During the last few years, however, with the realization of the agricultural and commercial possibilities of northern Alberta, the admirable situation of McMurray with regard to the waterways, in addition to the water-powers, timber, tar sand, and the possibility of oil in its vicinity, has re-awakened interest in it. Last season three companies were engaged in boring for oil between McMurray and Fort McKay, forty miles down stream. The season's results were considered satisfactory. Telegraphic connection with Edmonton is urgently needed and a winter road would be a great boon to the district.

The banks of Athabaska river are steep and range from 400 to 600 feet high, but below the juncture with the Clearwater the valley widens out forming extensive flats generally well wooded. Numerous islands occur in the river.

From its crossing in range 10 to range 17, the base line gradually diverged from the Athabaska, being about twenty miles north of it in the latter range. The country passed through was characteristic of the Athabaska country which might be generalized as follows. The strip adjacent to the river valley having a width of half a mile to several miles is well drained by numerous small streams, whose deep valleys as they approach the river make the country bordering the river valley extremely rough. This strip is generally well timbered where not fire-swept. Continuing back from the river muskegs are encountered in increasing number and extent till finally the country becomes muskeg, broken by islands and ridges of poplar and jackpine. As in the Clearwater district, there are no serious physical obstacles hindering drainage and usually the swampy surface is comparatively shallow. The surface moss is a poor conductor of heat so that the ice formed beneath it during the winter melts very slowly in the summer, thus preventing the country from drying up.

Two fairly large streams flow into the Athabaska from the north, one in range 10 and the other in range 14. This latter rises in several lakes in township 88, range 15, about which there are extensive hay meadows. The scarcity of horse feed made it necessary to start feeding oats on September 15, and on October 15 it was considered advisable to send out all the horses except the eight required for winter work. Transportation between the departure of the horses and the freeze-up, when we could use sleighs, was difficult. Heavy frosts occurred early in November freezing the muskegs sufficiently to bear the horses. This happened rather providentially as we were then camped on a point with burnt muskeg extending for miles on all sides except the east.

In range 15 the line entered the Thickwood hills which are composed of a series of ridges having a general northeast and southwest course, separated from one another by strips of muskeg. They extend from Athabaska to McKay river.

Snowstorms on November 6 and 7 marked the beginning of winter, the thermometer dropping to 30° below zero. On November 9 I divided the party, sending six men and four horses back to the Athabaska river, now 30 miles away, to open the pack-trail into a sleigh road and to bring on two sleigh loads of oats and supplies. Meanwhile the remainder of the men and horses I left to open up a trail to a cache at the Brule rapids on the Athabaska and to locate if possible some hay which an Indian was to have put up. Both parties encountered many difficulties and it was not till November 25 that the two parties united at the end of the line, arriving within a few minutes of each other.

The line continued through the Thickwood hills in ranges 15 and 16, passing through some good spruce, though here, too, the fires have done considerable damage. This timber could probably be handled either from the Athabaska or McKay rivers. The soil on these hills is excellent.

In range 17 the line dropped from the hills rather abruptly into a country principally muskeg which extends westward to range 20, rising slightly to the west. This country is drained on the north by McKay river and on the south by the Little Buffalo, both of which flow in an easterly direction into Athabaska river. The swampy surface is for the most part shallow as is evidenced by a heavy growth of large tamarack which covers most of this country. Several of the small feeders of McKay river cross the base line in range 19.

In range 20 ridges of jackpine occur and on the westerly side of the range a fairly large lake was crossed, the shores of which are heavily timbered with spruce, poplar, birch and jackpine. Several other lakes occur in the vicinity of the base line, in ranges 21 and 22. There is no well-defined ridge marking the height of land here although to the south it becomes quite pronounced. The levels and drainage indicate the centre of range 22 as being the summit of the height of land. Areas of good agricultural lands occur in the country adjacent to the height of land, especially in the vicinity of the lakes. The prevailing timber is poplar but much of it has been destroyed by fire.

Proceeding westward from the height of land large areas of muskeg, for the most part burnt over, are encountered. The relative amount of muskeg and poplar lands varies considerably in the Wabiskaw valley, the general impression received being favourable as to the agricultural possibilities of this district.

Wabiskaw river crosses the base line in the centre of range 23, and is about six chains wide. It is navigable from its principal source in Wabiskaw lake through to Peace river for scows drawing two feet of water. Its course is much broken by rapids but it is doubtful if power developed in these would have commercial value. In the vicinity of the base line its banks are from four to ten feet high and it flows through a valley fifty feet deep and half a mile wide.

West of the river, after passing through the poplar ridges immediately adjacent to it, muskeg country was encountered extending across range 24. Beyond this the country becomes hilly and rises sharply to the west. Formerly extensive forests flourished on these hills which continued to the west beyond the fifth meridian, but fires have destroyed much of them although some considerable patches of merchantable timber still remain.

The base line was completed to the fifth meridian on February 28, 1912, and after the completion of the necessary work for closing, the party set out for Athabaska Landing, arriving there on March 17.

APPENDIX No. 16.

ABSTRACT OF THE REPORT OF L. BRENOT, D.L.S.

SURVEY OF PART OF THE WESTERN BOUNDARY OF THE PEACE RIVER BLOCK.

Having completed the organization of my party, I left Edmonton on March 3, 1911, and proceeded via Athabaska Landing and Grouard to Peace River Crossing where I arrived on the 20th. From there I proceeded to Dunvegan on the ice and thence to Spirit River settlement. There I left my sleighs and proceeded westerly towards Pouce Coupé prairie by pack-trail, there being no sleigh road.

It would not be a difficult matter to convert this pack-trail into a sleigh trail, as not more than one-fifth the distance is heavily timbered, the remaining four-fifths having been burnt over so often that it is almost bare prairie.

From Pouce Coupé prairie I followed an old Indian pack-trail that leads northwesterly from Pouce Coupé to Peace river, and on April 15 arrived at the camp of Mr. Geo. McMillan, D.L.S., in range 15, on the twenty-first base, which he was then engaged in surveying. I with my party assisted Mr. McMillan to produce this base to the westerly boundary of the Peace River block which was reached on August 11, and the following day I began the survey of the western boundary of the block northerly from the base line.

I had completed the survey of this line to the north boundary of section 25, township 86, on September 28, when Mr. J. R. Akins, D.L.S., who had completed the survey of the north boundary of the block, came to my assistance with his party. The two parties working together made good progress and on October 12 the northwest corner of the block was reached.

At the intersection of the western and northern boundaries I erected a monument and besides the large iron post I placed a spruce post marked 'N.W. cor. P.R.B.'

Two days later I started homewards, reaching Spirit River settlement on November 10, and Edson on December 6. I paid off the party at Edmonton on the 11th and reached Ottawa on the 18th.

DESCRIPTION OF THE COUNTRY ALONG THE WESTERN BOUNDARY OF THE PEACE RIVER BLOCK NORTH OF THE 21ST BASE LINE.

The first mile and a half north of the base line is sloping down towards Peace river, which the boundary intersects at about half a mile below what is known as the Peace river canyon. On the south side of the river there is no flat, the hill ending abruptly at the edge of a cut bank about 120 feet above the water level. This cut bank greatly facilitated the triangulation of the river, as there are inaccessible wooded islands on the line and the south bank is covered with a heavy growth of small poplar. Down the river and situated approximately in the south-east quarter of section 13, township 81, range 26, lies Hudson Hope, which comprises only the fur-trading posts of Revillon Bros. and the Hudson's Bay Co. On the north side of the river is a small flat, which is heavily timbered with spruce, and from the top of the bank which is about 800 feet above the level of the river, to a little beyond the centre of township 81, there is a heavy growth of small poplar. The soil to this point is chiefly light sandy loam and not very good for agricultural purposes, while the country northwards to the northwest corner of township 81 is timbered with small spruce and jackpine. As the surface is covered with moss there is no vegetation. In section 23, township 81, the line crosses a pack-trail known as the 'Rocky mountain portage,' connecting Hudson Hope with Cust's House at the head of Peace river canyon.

Township 82 is fairly open, scattered second-growth poplar of about two inches and willow scrub being the only bush. It is perfectly level except sections 11 and 26 which are crossed by deep ravines through which flow Lynx creek and its north branch; both these creeks furnish an abundant supply of good clear water throughout the summer. The soil like that in the preceding township is not very suitable for agricultural purposes, and there is very little vegetation except at the bottom of the two ravines mentioned above.

The southern part of township 83 is rolling country and is timbered with poplar from three to eighteen inches in diameter, alder and willow scrub, but the northern half is covered with many hay meadows from which hundreds of tons of wild hay could easily be cut. The soil is of a much better class than that in the two preceding townships, being generally from three to twelve inches of humus overlying a subsoil of clay loam and in some places sandy loam. There is a good pack-trail leading from this township to the mouth of Halfway river.

A small river known to the Indians as the Red river and having an average width of one chain flows in a southeasterly direction through township 84 to Peace river. In its valley are numerous patches of open prairie, some being over a hundred acres in area. These prairie spots are covered with a luxuriant growth of pea-vine, the soil being extremely fertile. This would be an ideal place for ranching. Both banks of the river, which are over 200 feet high, afford good shelter for stock and the river furnishes an abundant supply of water. Brook-trout and grayling abound in this stream.

In the centre of township 85 we came across Ground Birch creek, which is from thirty to sixty links wide and two to three feet deep at low water. Being a mountain stream it rises very quickly and to a great height, the high water mark being about ten feet above its normal level. A fine prairie extends for about one and a half miles on either side of the creek. The soil of this tract is very good being chiefly humus three to six inches in depth overlying a sandy loam subsoil. The northern part of the township is timbered with heavy spruce and poplar from six to eighteen inches in diameter.

All of township 86 except section 35, in which Halfway river is crossed, is too broken to be suitable for settlement. It is timbered chiefly with jackpine and spruce from four to fourteen inches in diameter, with a thick undergrowth of willow scrub.

Halfway river at low water has an average width of three chains, a depth of four feet and a current of three miles per hour. Its source is in the Rockies and, like all mountain streams, it rises very quickly. At high water the average width is about ten chains.

On the north side of the river the country rises by benches up to the centre of township 87, range 25, there being an extensive flat after each rise. These flats are mostly prairie with a few scattered bluffs of poplar and some spruce. The soil is very fertile; in fact it is the best that was seen on this line, being composed chiefly of clay or sandy loam to a depth of eighteen inches.

In the southern part of township 87, the boundary intersects the R. N. W. M. P. pack-trail from Fort St. John to Fort Graham.

THE TRAIL FROM THE WEST BOUNDARY OF THE BLOCK TO FORT ST. JOHN.

This trail follows along the north side of Halfway river in an easterly direction for about twenty miles, then in a southeasterly direction to Cache creek, down the east side of the latter to its mouth at Peace river, and thence on the north side of Peace river to Fort St. John. Most of the country through which it passes is rolling open prairie. The soil varies, being very fertile in the valleys of the Halfway and Peace rivers, but poor and unsuitable for settlement elsewhere. As plenty of hay and water could be obtained, mixed farming should be a success in the valleys.

In the northern part of section 19, township 87, range 25, the country begins to fall gently to the north branch of Halfway river. The timber is chiefly jackpine and spruce, but there is also a great amount of deadfall. The north branch of Halfway river is a small stream about two chains in width and two to three feet in depth, with a current of about two to three miles per hour. It flows in a southeasterly direction and empties into Halfway river about fifteen miles from the intersection of the latter stream with the boundary. The country to the north of this branch rises gradually to a height of about 700 feet above the river. In the first three miles the land greatly resembles that north of the Halfway, but in the last two miles it slopes gently to the north and is timbered with heavy spruce and poplar from six to twenty-four inches.

During the summer months the heat is generally tempered by cool breezes blowing from the Rocky mountains, which lie about ten miles west and almost parallel to the western boundary of the block. There was no frost that would injure grain before September 18.

The game of this region comprises moose, bears, partridges, prairie-chickens and almost all species of fur-bearing animals, but ducks and geese are scarce.

APPENDIX No. 17.

REPORT OF M. P. BRIDGLAND, D.L.S.

TRIANGULATION SURVEY IN THE RAILWAY BELT OF BRITISH COLUMBIA.

CALGARY, March 4, 1912.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa.

SIR,—I have the honour to submit the following report of my field operations on the triangulation in British Columbia, in connection with the Trigonometrical Section of the Topographical Survey of Canada, for the season of 1911.

The work was commenced May 8, and in accordance with your instructions dated April 24, 1911, directing that the eastern part of the triangulation be retraced, an attempt was made to find station I, on the fifth meridian, and station II, on Nose hill.

At the latter station the old wooden hub was found. Station I was re-established as nearly as possible in its original position on the fifth meridian, 17·25 chains south of the northeast corner of section 13, township 24, range 1. Of the next four stations established by Mr. Drewry in 1890, old hubs were found at station V (Sarcee Butte), and station VI (Cochrane). At stations III and IV (Brushy Ridge and Spy Hill) no trace remained of the original stations, and these were accordingly re-established on the highest points of the ridges. Angles were read at all these points giving a new set of angles for four triangles at the eastern extremity of the system. Also stations III, IV and VI were connected with the nearest monuments of the Dominion Lands system. Each of the above stations was marked by a brass bolt embedded in cement, the top of the bolt being about two feet below the surface of the ground, and flush with the surface of the cement. The bolt in each case was stamped with a triangle and with the number of the station in Roman numerals. The apex of the triangle faces north, is at the centre of the head of the bolt, and is the geodetic point. For reference points three-foot iron posts were used and at least one placed at every station except station V. These posts were driven down to within about five inches of the top and were stamped with 'T.S.' and the number of the station on one side, and 'W.P.' followed by the distance in feet and the bearing to the station on the opposite side. At station V (Sarcee Butte) which was on a rocky ridge, two iron reference bolts were cemented into solid rock and their bearings and distances from the station measured.

An effort was also made to locate Mr. Drewry's base near Cochrane which he had established in 1890 and marked by iron bars. The post at the east end was found, but the post at the west end had evidently been removed.

As is usually the case in this class of work, considerable time was lost through unfavourable weather. Also much delay was caused by excessive refraction. It was found impossible to sight on signals with any certainty between 8 A.M. and 5 P.M., except on cloudy days.

On June 5, a start was made for Revelstoke, two of the party having been sent ahead to get the horses and outfit stored at Golden. A stop of one day was made at Morley to locate station VII (Chiniki) and connect it with the Dominion Lands system. The station was found and tied in to the post at the intersection of the north boundary of township 24, range 7, west of the fifth meridian, and the south boundary of the Stony Indian reserve. This station was not permanently marked.

By June 8 the party was camped at Revelstoke and ready to commence work on the western part of the triangulation. Owing to a very heavy snowfall and a later spring, work on the higher peaks was found to be impossible and a short exploratory trip was made to Salmon Arm to select points to help in the expansion of the base. The western part of Bastion mountain was visited but was found unsuitable. Permanent signals were erected on Granite mountain and on Fly hill about five miles southwest.

In the meantime two of the party had twice attempted to erect a signal on Queest mountain above Shuswap lake, but owing to the great depth of snow, they were unable to do so. Later on, about June 28, this was done. The ascent was made from Craigellachie, crossing Gorge creek some distance north of the railroad. There is much fine timber in this district. The ascent by this route, and also the descent, was found to be very tiresome and tedious. Later on the mountain was ascended from Malakawa, the ascent being made easily in about six hours.

An attempt was made to locate the sixth meridian, a short distance east of Revelstoke. Owing to fire and lumbering operations the monuments here have been destroyed and the nearest existing post is the northeast corner of section 34, township 23, two miles farther west. Owing to the canyon-like nature of the Illecillewaet valley it was found impossible to make a direct tie to Mount Albert, and later on a secondary station was established on Mount Mackenzie. This station served to connect Mount Albert with the above-mentioned section corner, and also helped to connect Mount Begbie and Mount Copeland with the northeast corner of section 33, township 23, range 2, west of the sixth meridian.

Throughout all of June and the early part of July, it was cloudy most of the time and considerable rain fell, so that it was very difficult to get any work done. Accordingly, having instructions to make connections between Cascade mountain (station XII) and Storm mountain (station XIV) Mount Bonney (station XXV) and the posts of the Dominion Lands system, it was decided to move to Banff, and on June 11 camp was pitched near the town.

A suitable base was found which could be connected by a short traverse to the middle of the north boundary of section 1, township 26, range 12, west of the fifth meridian. The ascent of Cascade mountain, from the west side offers no difficulty. An old wagon road leads up Fortymile creek to the water-works dam. From there the route leads northerly along the side of the mountain gradually ascending until a deep canyon is reached, whence a steep slope leads directly to the ridge from which the main peak is easily accessible. The slopes throughout are easy, there being no standing timber and very little windfall. The station lies on the highest southerly point of the mountain. The old cairn had fallen over but the base was still intact. It was rebuilt to a height of 6·7 feet.

On Juy 17, the party moved to Castle mountain. A good base about 143 chains long was obtained about two miles west of the station and by means of this, Storm mountain was connected with the survey posts in the valley. An azimuth observation was taken at the west end of the base. The route followed from the railroad to Storm mountain was practically the same as that described by Mr. Carson in his report of 1906, contained in the annual report of the Topographical Surveys Branch for the year 1906-1907.

Our next move was to Glacier where a base sixty chains in length was selected just east of the Ross Peak water-tank. By means of two secondary stations, one on the side of Mount Cheops and the other on Mount Abbott, this base was connected to Mount Bonney.

The ascent of Mount Bonney was made by what seems to be a new and very much easier route than those previously followed. A light camp was taken to the head of a small valley which joins Illecillewaet river about a mile west of Ross Peak station. From there a steep but easy climb leads to the snow field at the back of Mount Bonney. Crossing this snow field, the ridge above the basin of Loop creek

was reached and from there the arête runs directly to the summit. Under favourable circumstances it should not be a difficult matter to make the ascent from Glacier in a day and a half, if the first afternoon were devoted to taking camp to the head of the valley, and the day following to the ascent of the mountain and the return trip.

On the evening of August 4, we returned to Revelstoke. At first the smoke was very dense owing to forest fires close by, but heavy rains soon remedied this. As soon as the weather permitted, camp was taken part way up Mount Mackenzie, and on August 9, the peak was ascended and the return trip made to the railroad the same day. The route followed was the same as that taken in 1910. The station was, marked by the usual brass bolt stamped with a triangle and the number of the station 'XXXIVA.' The apex of the triangle faces north and is at the centre of the head of the bolt. Two iron reference bolts were also placed, one six feet south and the other six feet north from the station. A cairn five feet in diameter at the base and seven feet high was built above the station.

The next station visited was Albert (XXVII) following the route described by Mr. Carson in his report for the season of 1909, contained in the annual report of the Topographical Surveys Branch for the year 1909-10. Owing to difficulties connected with the location of station XXXII near Camborne, we could not complete the work at this point and had to return again later in the season.

On returning to Revelstoke, it was decided to visit Mount Griffin (XXXIX) leaving two of the party to ship the horses and outfit to Camborne, thus saving all the time usually lost in shipping and moving camp. Accordingly a light camp was taken to timber-line on Mount Griffin just below the signal following the same route as in 1910. Two days were spent there reading angles and taking azimuth observations. The station is marked by a brass bolt stamped with a triangle and the number of the station, 'XXXIX.' Two iron reference bolts were also placed, one 13·5 feet south and the other 18 feet north of the station. All bolts were cemented in solid rock. Above the station a cairn five feet in diameter at the base and 9·3 feet high was built.

On August 10, main camp was reached above Camborne. As soon as possible, camp was taken to timber-line below Mount Burniere following the trail to the Burniere mine. This trail had been recently cleared out and was in much better condition than in the previous year. On ascending Mount Burniere, the following day, it was found necessary to establish a station on a peak about 500 feet higher and about two miles farther west. This peak proved to be very suitable for a station and angles were read and an azimuth observation taken. This station was called Incomappleux.

The peak consists of a long narrow ridge with precipitous rock faces on the south side and glaciers on the north. The station is near the eastern end of the ridge, and is marked by a brass bolt stamped with a triangle and the number of the station, 'XXXII.' Four reference bolts, marked, were placed as follows: the first four feet north, the second and third each distant five feet from the centre and bearing south 65° east and south 20° west respectively, and the fourth four feet distant and bearing south 55° west. All bolts were cemented in solid rock. Over the station a cairn four feet in diameter at the base and 6·5 feet high was built.

At Mount Burniere, a secondary station was established. This station overlooks the Incomappleux valley and should be very useful for making any necessary connection with the monuments of the Dominion Lands system in the valley. The station was marked by the usual brass bolt stamped with a triangle and the number of the station, 'XXXIIA.' Four reference bolts were placed as follows: one north 5·5 feet, the second north 84° east and 6·3 feet distant, the third bearing south 34° 30′ east and distant 7·9 feet, and the fourth bearing north 82° west and 12·6 feet distant from the centre. A cairn five feet in diameter at the base and 8·4 feet high was built.

On August 29 we returned to Revelstoke, but were again delayed by rain. As soon as the weather permitted, we again ascended Mount Albert and completed the work there. An azimuth observation was also taken at this point.

On September 5 a start was made for Mount Copeland, near the head of Jordan river. The Jordan trail had been partially repaired during the summer, but it was still in poor condition. On the first day camp was taken as far as possible by horses and on the second a light camp was taken to an amphitheatre below the peak. Two days were lost through bad weather, but the third day was beautifully clear. The station is marked by a brass bolt stamped with a triangle and the number of the station, 'XXXVII.' Three reference bolts were placed as follows: one bearing south 82° east and distant 4·7 feet, the second bearing south 5° west and distant 7·1 feet, and the third bearing north 36° 30′ west and distant 7·0 feet from the station. A cairn five feet in diameter at the base and seven feet high was built.

On September 10 we again reached Revelstoke, and next day started for Mount Begbie, hoping that we might have a few days of continuous fine weather. This hope was vain. We camped at an elevation of about 6,500 feet on the side of Mount Begbie the second day. The weather had been fine but about four o'clock heavy black clouds rolled over the summit and it was not until September 25 that we were able to make the ascent. Then the mountain was covered with about eighteen inches of fresh snow and the weather was cold, making instrument work on top very difficult and disagreeable. This station is on the highest eastern point of the mountain. It is marked by a brass bolt stamped with a triangle and 'XXXVIII.' Three reference iron bolts were placed, each six feet from the station and bearing east, south and west, respectively, from it.

The party next moved to Enderby and camped on Shuswap river, a short distance below the village. While preparations were being made to visit Mount Mara and Mabel mountain, a station was established on a low bare knoll near the northeast corner of section 22, township 19, range 9, west of the sixth meridian. The station is marked by a brass bolt stamped with a triangle and the letter 'E.' Three iron reference bolts were placed, one bearing south 12° 25′ east and distant 12·3 feet, the second bearing south 53° west and distant 12·2 feet, and the third bearing north 56° 20′ west and distant 4·7 feet from the centre. All bolts are cemented in solid rock.

On October 2 we started for Mount Mara near the summit of the Hunters range. The route followed was exactly the same as that taken the previous year. The signal was marked by a brass bolt stamped with a triangle and the number of the station, 'XLII.' Four iron reference bolts were placed bearing north, east, south and west from the signal, the first three being six feet and the fourth nine feet distant from it. All bolts were cemented in solid rock.

The next trip was to Mabel mountain. This was reached by crossing Mabel lake and following the Indian trail up the mountain. The trail has not been used recently and is fast becoming obliterated. The station itself lies in the western part of the summit, overlooking Mabel lake. It is marked by the usual brass bolt stamped with a triangle and the number of the station, 'XLI.' Four iron reference bolts were placed as follows: the first north 4° 30′ east and distant 4·4 feet, the second north 71° 00′ east and distant 11·3 feet, the third south 32° 30′ west and distant 11·2 feet, and the fourth north 66° 40′ west and distant 10·5 feet from the signal. All bolts were cemented in solid rock. On the west bank of Kingfisher creek, starting at the northeast corner of section 15, township 19, range 6, a line about 120 chains long was run in a northwesterly direction. This line was carefully measured and affords a direct tie to the iron post at the above section corner.

Our next move was to Salmon Arm. From here a light camp was taken up to Malakawa in order to ascend Queest mountain. On October 20 we started and reached the summit about two o'clock. Owing to clouds and slight snow flurries, we could do nothing that evening and spent the night shivering around a camp-fire. Fortun-

ately the next morning was clear and we completed our work and returned to Malakawa in time to catch the evening train to Salmon Arm. At Quest mountain (station 'XLIII') no permanent marks were left. The station is on the southwest point of the mountain and is marked by a cairn four feet in diameter at the base and 6.5 feet high.

On returning to Salmon Arm a few days were spent ranging out the base and taking magnetic observations where possible. The horses were sent down to Vernon, arrangements having been made to winter them there, and on October 28 the outfit was shipped to Calgary.

On November 1, finding it possible to do so, I took an azimuth observation at station I, on the fifth meridian, using as a reference object a signal at station II, on Nose hill.

From October 3 to 23 I was engaged in making a survey of some villa lots at Banff, and a correction survey near Airdrie, in township 27, range 1, west of the fifth meridian. Owing to snow and intensely cold weather it was found impossible to make satisfactory progress and consequently when the latter survey was completed, I closed work for the season.

I have the honour to be, Sir,

Your obedient servant,

M. P. BRIDGLAND, D.L.S.

SESSIONAL PAPER No. 25b

APPENDIX No. 18.

ABSTRACT OF THE REPORT OF A. V. CHASE, D. L. S.

EXAMINATION OF LAND AND MISCELLANEOUS SURVEYS IN THE KAMLOOPS DISTRICT OF THE RAILWAY BELT.

The examination of that portion of the Tranquille forest reserve not done by R. D. McCaw, D. L. S., in 1910, was our first work of the season. This portion of the reserve is very rough and rolling. There is no merchantable timber and except for a few stretches of grazing land it might be considered useless were it not for the fact that the thick growth of small scrub timber, which proves more or less of a snow shelter, prevents too rapid evaporation of the moisture collected there during the winter, and thus acts as a sort of reservoir to regulate the stream flow. It is all over 4,000 feet above sea-level and its highest point is 6,000 feet.

The valley of Tranquille river in townships 22 and 23, range 20, west of the sixth meridian was next examined. The surface in the latter township is composed of steeply sloping land and gulches, very rough and useless for agricultural purposes. Some merchantable fir is found in the southwest part of the township, but the grazing has been destroyed by the frequent forest fires, except in a few flats and sloughs.

The land in the valley of Criss creek in township 23, range 21, is all steep and precipitous, and unfit for cultivation of any kind, but some land suitable for growing hay and the hardier vegetables lies along this creek in township 24, range 20. The possibility of growing cereals there is doubtful as frost occurred very frequently in July.

On the hills east and west of Criss creek there is considerable fir and bull pine of medium size, chiefly in the western part of township 23, but to the north in township 24 and in the higher altitudes this is replaced by smaller timber and scrub with jackpine. Some good grazing land is found in the northwest part of township 23, range 21.

Our next work was the examination of lands along Deadman river and its tributaries north of the sixth correction line. This river flows southwesterly through a valley bounded by steep precipitous hills, showing outcrops of solid rock on the west side and steeply rolling land on the east side. Almost all the good workable bottomland in this valley is disposed of. Some fir of medium size grows on the slope east of Deadman river, and jackpine grows farther north. There is very little grazing land in this valley.

Rising rapidly from Deadman river toward the west the land reaches an altitude of 4,000 feet above sea-level in about two miles, while the centre of township 23, range 23, is about 5,700 feet. Although large areas of jackpine occur, there is no timber of merchantable value, but some meadows were found in township 23, range 23, and timber grass grows throughout the whole area.

On July 26 I moved camp to Pass valley and commenced the examination of lands in ranges 23 and 24, south of the sixth correction line, and north of Thompson river. Range 23 of this locality is very rough, particularly in the valley of Eightmile creek north of Pass valley. No agricultural land that could be profitably irrigated was found although attempts have evidently been made to bring water from Cache creek into this range, a ditch having been found running from Cache creek, through a small area of workable land in the northwest corner of township 21, and emptying into Tsotin lake which in turn is a reservoir for Eightmile creek. Land in this area

rises rapidly to the north from Pass valley reaching a height of 4,000 feet above sea-level at a distance of from one and one-half to two miles therefrom. To the west of Eightmile creek valley, the land rises to Cache creek hills and towards the east to over 4,000 feet above sea-level in the northeast part of township 21, range 23. The timber of value found in township 22, range 23, consists of an area of fir of medium size in the neighbourhood of Pass valley in the southeast portion of the township. Some grazing land is found in the southern part consisting principally of timber grass of fair quality. Except for the above-mentioned area, all the land is timbered, jackpine and scrub predominating.

Township 21, range 23, is more open, the only timber of note being found on about three square miles of the heights of Cache creek hills to the west of Eightmile creek, and from four to five square miles in the northeasterly part of the township. It consists mostly of fir and bull pine of medium size with jackpine predominating in the higher altitude in the northeast part. The open land in the immediate vicinity of Eightmile creek is rough and rolling and fit only for grazing, as is nearly all of the undisposed-of part of the south half of this township, north of Thompson river. Owing to its low altitude and extreme heat, most of this land has been burned almost bare of grass of any kind.

Moving camp to a point on Cache creek near the north boundary of township 21, on July 29, I continued the examination in range 24, in townships 21 and 22. The former is traversed through the centre from east to west by Semlin valley which lying at an elevation averaging 1,700 feet above sea-level, comprises nearly all the lands of agricultural value in this township, except those along Bonaparte river. That part of the undisposed-of lands in this township south of Semlin valley and east of Bonaparte river is composed almost altogether of high, open, rolling land with light slightly alkaline soil, gravelly in places, in such a position as to present no possibilities of profitable irrigation and is useful only as grazing land. To the west of Bonaparte river the land rises very steeply and the undisposed-of parts are of no agricultural value on account of the excessive cost of irrigating such small workable flats from the only available source of water, Bonaparte river. Undisposed-of lands to the north of Semlin valley are composed almost entirely of high rocky hills, fairly well timbered in the northeasterly part of the township with scrub fir and bull pine of medium size, but they are more open near Cache creek and Semlin valley. These hills give fair grazing on the north slopes. In Semlin valley itself there are some small areas of undisposed-of workable land to the north of the lands already taken up, but as there is not sufficient water supply to irrigate the lands already patented, there is small chance of these other small areas being of any agricultural value. An estimate by a competent engineer was made in the interests of the settlers in this valley of the cost of bringing water from Bonaparte river. He found on account of the small amount of fall per mile in the Bonaparte that it would cost in the neighbourhood of $80,000, a price considered prohibitive, considering the small additional area that would be served.

In township 22, range 24, the land rises steeply to the north reaching an elevation of 4,000 feet above sea-level at a distance of from one and one-half to two and one-half miles north of the south boundary. The land is very rough with the exception of a small area along the south boundary in sections 1 and 2, where probably eighty acres of workable land is found. The only timber of value grows along the south boundary and consists of fir and bull pine of medium size, but these quickly give place to jackpine as one goes north. Grazing is poor on the south slopes.

The lands in Scottie creek valley in township 23, range 25, are in general of a steep, precipitous nature, although a small area of workable sandy loam soil was found along the north side of the creek near the east boundary of the township, at an elevation of about 3,000 feet above sea-level. This area could be irrigated and would probably be fit for cereals as it is fairly well sheltered. The land rises rapidly to the north and south of Scottie creek, and eastward toward the centre of township 23.

range 23. About three square miles of ranges 23 and 24 in this watershed and in the neighbourhood of Hi-Hium creek are below 4,000 feet above sea-level, but the remainder is all high land. The only other lands adjacent to Scottie creek of possible agricultural value are along a small branch of Scottie creek in the northeast part of township 23, range 25. Some areas here are of good flat workable land but adequate irrigation does not appear a profitable possibility. East of the centre of range 24 and north of the sixth correction line the land is all timbered with small growth, mostly of jackpine. Recent fires have burned over most of the east half of township 23, range 24, and a small portion of the southeast part of fractional township 24, range 24, destroying most of the small growth as well as some of the larger jackpine. There is considerable fir of medium size to the south of Scottie creek in range 25, and bull pine with stretches of small jackpine to the north. Some very good grazing land exists in this valley.

The valley of the Bonaparte through townships 22 and 23 presents no workable land which is not disposed of with the exception of a small area adjoining the northern boundary of the railway belt. Possibly an area of fifty acres of the west half of section 29 is workable land. Being at an elevation of 1,800 feet above sea-level this is of agricultural value. These townships are chiefly remarkable for the rough, steep nature of the land adjoining the valleys; much outcrop of solid rock shows to the east of the Bonaparte and steeply rolling land lies to the west. In the lower altitudes the land is rather barren of either timber or grass growth, but as the altitude increases east or west, scrub timber appears, changing to bull pine and fir of medium size at an altitude of about 3,500 feet above sea-level. Timber grass is found in fair quantities where the timber grows thickly.

The valley of Maiden creek holds only very little undisposed-of or irrigable land of agricultural value. This is in section 3, township 23, range 26, and is of such small acreage as to be unworthy of attention. Its altitude, about 3,700 feet above sea-level, is such as to exclude anything but hay growing. The slopes on the south side of Maiden creek present a very fair and uniform growth of fir and scattered bull pine, but on the slopes having a southern exposure the timber is more of a scrubby variety. Grazing is also much better on the shaded north slopes than on the more exposed south slopes.

The valley of Hat creek, through township 22, is very rough in those lands not disposed of, rising steeply to the north and south of the creek bottom to over 5,000 feet in the west part of the township and to 5,000 feet in the Trachyte hills in the east part of township 21, range 26. This area shows no agricultural land of sufficient extent to warrant the expense of irrigation, the small areas of workable land being of such location as to make profitable irrigation, considering the area, very impracticable.

The southeasterly slopes to the northwest of Hat creek are very rough and precipitous, especially in the west part of townships 22, ranges 26 and 27. The land is in general timbered, with open stretches near the creek bottom. On account of the amount of rocky country in this locality, the timber is of rather small size and not of merchantable value. The northerly slopes to the southeast of Hat creek are covered with a better class of timber, although in the immediate vicinity of the creek bottom the land is somewhat open as on the north side. No land of agricultural value was discovered in this locality.

On September 19 I proceeded to Lytton to arrange for the commencement of miscellaneous surveys in that district and on September 25, having completed arrangements and procured the additional men for my party, I moved to Canford to commence subdivision work in township 14, range 23. I surveyed the north boundary and east and west centre line of section 11 and ran a small portion of the east boundary of Lower Nicola Indian reserve No. 10 to determine the bearing thereof and tied the east boundary by traverse to the Dominion system. With the exception of the river-flats of small acreage this locality is rolling, hilly country, timbered with bull pine and fir.

On October 5 I moved to Lytton and proceeded to survey a small portion of the fourth correction line where it crosses Fraser river and a portion of section 35, township 14, range 27, west of Fraser river. I made a traverse of the east bank of Fraser river through sections 26 and 35 of the same township and also of the south bank of Thompson river in township 15, range 26, as far up-stream as could be conveniently done from this camp, and surveyed a portion of the north boundary of section 8.

I next traversed the north side of Thompson river easterly until compelled to abandon this by the blasting operations of the Canadian Northern railway construction. I also surveyed portions of sections 7, 8, 17 and 18 in this township. I found one new settler in section 17, developing a very good bench of about forty acres, but the remainder of the area surveyed is very steeply rolling and of little value except for timber and grazing.

On October 31 I commenced the traverse of Fraser river on the west bank through sections 2, 11, 14 and 27, township 14, range 27, and tied Lytton Indian reserve No. 26 to the Dominion system. I then continued the traverse of Fraser river southerly on the east bank through section 36, township 13, range 27, tying on to what appeared to be the remains of a wooden post, mound and bearing trees on the north boundary of Kanaka Bar Indian reserve No. 2.

Heavy rains and snowstorms becoming prevalent I discontinued work in this locality and with the temperature 7° below zero, moved north with a view to continuing the work on Thompson river traverse and tying in all the unfinished work there, reaching Gladwin on November 11. On account of weather conditions, I discontinued the work after tying in the traverses to section 10, townhsip 15, range 26. I moved in to Lytton on November 16 and after shipping my outfit to Kamloops, disbanded the party.

APPENDIX No. 19.

ABSTRACT OF THE REPORT OF A. L. CUMMING, D.L.S.

MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

The first work of the season, which consisted of the complete retracement of township 7, range 23, west of the third meridian, was commenced on May 28. The northerly two-thirds of this township is a high gently rolling prairie. The southern portion is broken by two large coulees which afford the best shelter for cattle during the winter, and are largely used by ranchers as a winter camp. Pearce's coulee, through which Frenchman river flows, runs in a southeasterly direction and occupies sections 1, 2, 3 and 12. A rancher is located on section 2 and has a large part of it under irrigation. The other coulee runs north from section 2 including parts of sections 11, 14, 15, 22 and 23, and is thickly overgrown with willow and small poplar. Both coulees vary in width from one hundred yards to one mile.

The soil is mostly clay and the township is well suited for mixed farming or ranching. A few outcrops of lignite and bituminous coal were found but no large seams were discovered. Beaver are very plentiful in Pearce's coulee.

Township 7, range 24, which I next resurveyed, is very similar in the character of the soil and general appearance to township 7, range 23. The northerly two-thirds is practically all settled and a great portion of it is under cultivation. The township is well supplied with water as four creeks run through it. Outcrops of coal are found, and a seam is being worked at the north boundary, which supplies the local demand. Although this township is very well adapted for farming it is even better suited for ranching.

My next work was in townships 19 and 20, ranges 7 and 8, west of the fifth meridian. I went by rail from Swift Current to High river and proceeded from the latter place with wagons up the north fork of Sheep river through Black Diamond and Millarville to the northeast corner of section 33, township 20, range 4. From there I used a pack outfit following a rough trail along the north fork of Sheep river through excellent cattle ranching country. After following the river for about ten miles we branched to the north and proceeded by a very circuitous route to the northeast corner of township 20, range 7, arriving there on August 11.

This district is very mountainous, some of the peaks being over ten thousand feet high. The highest limestone ridges are bare and broken, while the slopes are covered with heavy spruce and jackpine with some heavy windfall. The sides of the mountains are deeply gorged in many places which made the work both difficult and dangerous. The locality can be more easily reached by the wagon road which follows the south branch of Sheep river, and at almost any season of the year heavy loads can be hauled over this road which is now opened up to section 9, township 19, range 6.

The south fork of Sheep river flows through the centre of township 19, range 7; its valley varies from a quarter of a mile to two miles in width. The south half of this township contains exceedingly rich coal fields, and it is claimed that the coal is a semi-anthracite containing 75 per cent of carbon.

The mountain slope is heavily timbered with spruce and some tamarack, but considerable damage has been done by fire. Building stone could be quarried. The soil is a clay mixed with gravel except in the valley where it is much richer. Game consisting of caribou, deer, bears, mountain-sheep, foxes, wolves and partridges is found.

Owing to unfavourable weather I closed operations on December 7, and disbanded my party, retaining only one assistant with whom I was engaged on miscellaneous surveys near Edmonton until January 24, 1912.

APPENDIX No. 20.

ABSTRACT OF THE REPORT OF H. S. DAY, D.L.S.

SETTLEMENT SURVEYS IN NORTHERN ALBERTA.

Leaving Edmonton on May 30, 1911, we travelled by trail to Athabaska Landing. From here, having secured a scow, we proceeded by water to Pelican portage, travelling through a country which appeared to be heavily timbered chiefly with spruce and poplar, and making the journey of one hundred and twenty miles in three days and two nights.

I laid out eighteen lots here on the west side of the river. The valley at this place is not very wide and is almost three hundred feet deep. From the top of the hill the country is quite level and is covered with poplar, spruce, balsam and some birch. A short distance back from the edge of the valley are swamps extending all the way to Wabiskaw. These swamps, however, are not over eighteen inches deep and when the timber and moss are removed the land will be good for farming.

The soil throughout the settlement at Pelican portage is first and second class, and the timber, though good in places, is not sufficient to warrant the survey of timber berths. A gas well, bored fifteen years ago, is still burning with a flame of about thirty feet. It is hoped to also find oil here and an oil boring outfit is being placed in readiness to begin operations in the spring. A winter road extends from Pelican portage to Wabiskaw, and is very much used by the trading companies.

The country around Grand Rapids, forty miles from Pelican portage, where my next survey work was, has been burned over, and a scrubby growth of willow, poplar and spruce has grown up among the deadfall. The valley here ranges in depth from three hundred and fifty to five hundred feet. Some of the land is well adapted to farming, but a large amount of it is very wet. The river is from twenty-five to thirty-five chains wide and has cut its way through a ridge of sandstone which extends two miles above and one mile below Grand Rapids island. An enormous amount of power could be developed here as there is a drop of about sixty feet in half a mile.

I laid out twenty-eight lots on the easterly side of the river, and traversed Grand Rapids island, leaving for McMurray, ninety miles distant, on August 18. This distance was covered in less than thirteen hours, and as it is practically all rapids the trip proved very exciting.

About thirty miles above McMurray the tar sands commence, the tar banks in places being one hundred and fifty feet high. The valley on the western side of the river at McMurray is three hundred and fifty feet deep, but there are several river flats with excellent soil in the vicinity. The timber consists of very thick poplar, spruce and birch, the spruce being heavy but too scattered to be of much value. The whole country is underlaid with tar either in sand or limestone formation and it seems probable that this tar deposit will have much to do with the future development of the district. Some of this tar sand was laid on the streets of Edmonton, Calgary and Vancouver last summer and seems to make an excellent paving.

With the large quantity of pulpwood in sight there is an excellent opportunity for the manufacture of tar paper; moreover the sand after removing the tar is, according to a geological report, of excellent quality for manufacturing glass. Some attempts have been made to burn the limestone of this district and the results show a very good quality of lime. There are also large deposits of salt. The soil is good throughout and several settlers have fine gardens in which they raise all kinds of vegetables.

I laid out fourteen lots on the westerly side of the river, and these will probably be homesteaded very soon, but as the twenty-third base line has already been surveyed it did not seem advisable to lay out more lots. I connected my survey with the base line and also with Mr. Selby's survey of 1910.

Work being finished here on September 22, I moved to McKay, thirty-five miles distant, the tar sands and limestone continuing to show all along the river.

At McKay the valley of the river is not more than fifty feet deep. The timber while heavy in places has mostly been burned and replaced by a scrubby growth of spruce and poplar with some jackpine. On the westerly side of the river the country is generally level except where it is broken by the valley of McKay river. There is, however, a great deal of swamp and the soil is generally poor.

The Athabaska Oil and Asphalt company started boring operations for oil last summer. There are indications of coal under the settlement and from a boring made by Mr. Von Hammerstein there is a stream of brine flowing. The odor of sulphuretted hydrogen can be detected at least a quarter of a mile from this well.

After laying out seventeen lots here we left for Chipewyan on October 13 and continued to pass banks of tar sand until thirty miles below McKay. Ten miles below McKay Col. Fenn is at present boring for oil. He bored through eighty feet of tar sand and sixty feet of pure tar which it is claimed contains a large percentage of oil.

Good progress was made until we reached the mouth of Athabaska river where we were detained by head winds for three days and reached Chipewyan only on the 21st having taken nine days to make the one hundred and ninety mile trip.

The north shore of Athabaska lake is practically all rock with a scrubby growth of jackpine, poplar, spruce and willow. There are occasional patches of soil where the Indians have small gardens. The position of the settlement suits the Indians very well as the fur catch is very large each year and Athabaska lake is well supplied with fish, which is a large item in the Indian's diet and on which he feeds his dogs entirely. The southern side of the lake is probably the largest breeding ground for geese and ducks in America. The settlers, most of whom are well to do, shoot large numbers of them, one man managing to secure nine hundred and sixty geese in two weeks.

After laying out forty-two lots, some of which were necessarily very small, at Chipewyan, we left for Edmonton, arriving there on December 12.

APPENDIX No. 21.

ABSTRACT OF THE REPORT OF W. J. DEANS, D. L. S.

MISCELLANEOUS SURVEYS IN THE RAILWAY BELT, BRITISH COLUMBIA.

I left Vancouver on May 16 for my first work of the season which consisted in laying out timber berth No. 544 in section 34, township 2, west of the coast meridian.

This section is situated about one mile south of Port Mann, the new city which the Canadian Northern Railway company is building on Fraser river. The land is consequently very valuable, the adjoining lands being held at from three to four thousand dollars an acre. The surface is undulating and covered with a thick growth of large fir and cedar with heavy underbrush. The soil is either black loam or clay and would produce fruit, vegetables or grain. The Yale and Westminster wagon road which runs through this section was widened during the past season for the convenience of automobiles and now forms part of a through automobile road to the gulf of Mexico.

My next work was the survey of a portion of section 10, township 38, west of the coast meridian, after which I surveyed timber berth No. 553, in township 17, east of the coast meridian. The lands comprising this berth are situated about one mile north of the Canadian Pacific railway and are at a height of from 500 to 800 feet above Fraser river. The surface is hilly and covered with fir, hemlock, cedar and thick underbrush. The soil is good, mostly clay and is well adapted for garden vegetables, small fruits and grain. The settlers in this part are engaged in dairying and raising small fruits and poultry. The principal market is Mission City. From this station the fruit is shipped to points as far east as Winnipeg, one hundred and ten thousand dollars' worth having been shipped during the season of 1910. A jam factory which is located there uses such fruit as will not stand shipping on account of ripeness.

The Northern Power company are developing power from Stave lake and have in course of construction an electric railway which will run close to timber berth No. 553. This will afford cheap and efficient transportation and will enable the settlers to go more extensively into farming pursuits and fruit culture.

Having finished this work on June 26, I performed two small surveys, one in section 2, township 4, range 29, and the other in sections 9 and 10, township 4, range 26, west of the sixth meridian. In the latter survey most of the land occupies the side of a steep mountain and is covered with a growth of alder, birch and poplar, interspersed with some large cedar and fir. The soil is loose rock mixed with clay and is not suitable for agricultural purposes. Strawberries grow in great profusion along the shore of Harrison river and when cultivated attain a great size. The market however is very limited so that extensive cultivation would be useless at the present time. The waters of the river abound with fish.

My next work was to retrace the boundaries of section 19, township 22, east of the coast meridian, near Sumas lake. The settlers around this lake are engaged in cattle raising, dairying and fruit raising. The low land around the lake known as Sumas prairie produces large quantities of hay and is well adapted for the growing of small fruits, while the bench lands situated about twenty or thirty feet above the lake are especially well adapted for the cultivation of cherries, those produced being unexcelled for size, colour and flavour. The B. C. E. railway skirts the shore of the lake making the place easy of access.

On July 17 I moved to Cultus lake to survey sections 18, 19 and 20, in township 25, east of the coast meridian. These sections are very rough and covered with heavy timber, only small patches being suitable for agricultural purposes. After surveying the south boundaries of sections 2 and 3, in township 19, and investigating the divergence between the international boundary and the south boundary of section 5, township 22, east of the coast meridian, I left for township 3, range 29, west of the sixth meridian, where I completed a small survey, and made some small additional surveys in timber berth No. 553, in township 17, east of the coast meridian.

We completed this work on September 26, and moved to township 20, east of the coast meridian to survey lands suitable for farming purposes and to traverse the south shore of Fraser river through the township. Owing to the recent construction of the Canadian Northern railway through this township most of the original monuments along the river have been destroyed. I extended the line from the north side of the river and retraced a number of lines in order to obtain closings within reasonable limits. Three squatters along the flats near the railway are engaged in fishing and raising a few cattle and vegetables.

In township 8, range 26, west of the sixth meridian, I expected to run about fifteen miles, but about two weeks were spent trying to locate reference posts along the railway, most of these having long ago disappeared. I retraced about five miles of the C. P. R. traverse and reestablished reference points on rocks, cutting an arrow with an old drill. I also retraced the boundaries of the Indian reserve to the south of Spuzzum creek and also the boundaries of lot 4.

Owing to unfavourable weather conditions I closed operations on November 20.

APPENDIX No. 22.

ABSTRACT OF THE REPORT OF J. A. FLETCHER, D.L.S.

OBSERVATIONS FOR LATITUDE IN NORTHERN ALBERTA.

I left Ottawa on June 12, 1911, and travelled via Edmonton, Athabaska Landing, Athabaska river and Clearwater river to the fourth meridian in township 89, where my first observation was taken.

Arriving at Athabaska Landing too late to travel by the Hudson's Bay company's boats I was compelled to travel the remaining distance by canoes. Accordingly I hired two experienced rivermen, one for each canoe, and left Athabaska Landing on June 26.

The current in Athabaska river is quite strong and good progress was made down the river by simply drifting. The only place along the river where farming was attempted was at Calling river where mixed farming is carried on successfully. The absence of open land along the river retards settlement in most places. At Grand rapids the outfit was portaged on the tramway to the foot of the island which is about half a mile long. Some companies have proposed developing power at Grand rapids, but the long transmission required, over 170 miles to Edmonton, has prevented the installation of a power plant. Fifty thousand horse-power could be developed easily. Owing to the recent rains the water in the river was quite high and as the swells at the foot of Grand Rapids island were larger than usual some difficulty was experienced loading the canoes. The weight of the outfit added somewhat to the danger of running the rapids at this point, but the trip was made without any damage to the instruments, only a small amount of water being taken in each canoe.

From Grand rapids to McMurray the river runs much faster, but the rapids may all be run with a canoe lightly loaded. At the Crooked rapids and also at Big Cascade rapids, the canoes were let down close to the shore by means of a rope. In this way the large swells due to the high water were avoided. At Mountain rapids the outfit was portaged about three hundred yards along the south bank of the river. From McMurray the remainder of the canoe trip was made up-stream against the current of Clearwater river. We paddled part of the way, but where the water was sufficiently shallow a pole from ten to twelve feet long was used to pole up. An experienced man with a pole in the stern of a loaded canoe can travel as fast as two men paddling. The trip from McMurray to Cascade rapids was made in three days.

From the Cascade rapids to the fourth meridian there are several rapids and some long portages which rendered pack-horses necessary for the remainder of the trip. The canoemen were paid off here and Mr. Blanchet, D.L.S., who was working on the twenty-third base line in this vicinity, furnished me with five horses in charge of his second packer. We followed the pack trail along the north side of the river as far as the meridian. This trail is rather steep in several places, but the footing is good.

There is considerable merchantable spruce along the valley of Clearwater river. This valley is from one to two miles wide and is wooded with poplar, jackpine, spruce and birch. A few open spots occur along the river-valley, the only one of any extent being at the junction of the Pembina and Clearwater rivers, where some good land is seen. Grass grows abundantly for a timbered country and pea-vine is noticed in considerable quantity all along the river.

The fourth meridian was reached on July 15, and as the weather was favourable for observing, in ten days I had observed and computed sufficient pairs of stars to be assured that the resulting latitude was of the accuracy desired.

On clear nights the thermometer dropped regularly to almost freezing-point but did not go below. The sun rose very early in July at this latitude (56° 42′) and by nine o'clock in the morning the shade was very agreeable. The temperature was much more uniform in cloudy weather, and cold nights were not in evidence. While on the fourth meridian several jackfish were caught in Clearwater river with a trolling line. These fish weighed from five to twelve pounds and were in good condition owing to the water in the river being rather cold. There are some beaver along the river, as evidenced by the poplar trees having been felled and the bark eaten. Muskrats and porcupines as well as ducks and partridges were seen. Bear and moose tracks were also frequently noticed.

We returned to McMurray and travelled up Athabaska river with the Hudson's Bay company's transport which left McMurray on August 9. For transportation of freight between McMurray and Pelican flat-bottomed scows are used, each carrying about five tons and tracked by ten men, the crews doubling at the rapids. The steamer, *Northland Sun,* met the scows at Pelican and the freight was transferred from the scows to the steamer. It took about three and a half days for the steamer to reach Athabaska Landing.

Observations were next taken on the principal meridian at two points, on the north shore of Lake Winnipeg, in township 48, near Big Black river fishing station, and on the south shore in township 35, near Kinwow bay. The station near Big Black river was very conveniently reached, as the Northern Fish company who own this station run the steamer *Wolverine* quite frequently to the northern end of the lake.

A short distance back from the shore swampy country is met and north of township 30 practically no homesteading has taken place on lake Winnipeg. Large quantities of whitefish, pickerel, jacktish, and goldeye are shipped annually from lake Winnipeg. The principal meridian strikes the northern shore about three miles from Big Black river and is easily reached by rowboat. Considerable cloudy and hazy weather was experienced at this station but by September 23 sufficient observations had been taken. We left Big Black river on the 25th and reached Snake island that night. From Snake island we went by sailboat to the principal meridian in township 35, reaching there on the 29th. Rain for a few days delayed observations but the succeeding weather was ideal for observing. The sky was cloudless and the air clear, while the temperature was delightful, the minimum ranging from 40° to 50° F. each night. By October 9 the observation was completed, and we returned to Snake island in time to catch the steamer *Wolverine* on the return trip to Selkirk.

The last observation was taken in township sixty-two, on the fourth meridian. From Lloydminster we followed the meridian trail to Onion lake. A large part of the wheat in this district suffered from the frost as the large amount of rainfall during the summer caused a greater growth of straw than usual and the ripening of the grain was delayed. Many of the settlers in this district are just starting farming and have no live stock to which the frozen grain could be fed. They are forced to sell their wheat at about thirty-five cents per bushel, and when it is considered that it takes a large quantity of frozen grain to make a bushel, the price realized is small. Those with stock to feed fare much better as the price for live stock is good. It would seem that the settlers in this district who go in for mixed farming and do not rely on the wheat crop alone are much more successful. Several settlers have located north of Saskatchewan river and the land there seems well adapted for grazing, water and natural shelter being available in all localities. From Onion lake the trail was followed by way of Frog lake to Cold lake. The land in the neighbourhood of the lake at this latter place is first class and much of the country is open. During the season of 1911 upwards of one hundred homesteaders are said to have located in this vicinity. Cold lake has a fine gravelly beach and the water is exceptionally clear. This lake has been over-fished in recent years and for the winter, 1911-12, the fishermen have moved to Primrose lake farther north.

During the first three weeks of November the weather was very cold and for the most part cloudy. Most of the observations on the fourth meridian, in township 62, were taken at temperatures from 10° to 20° below zero. On November 14 our work being finished we left for home, going first to Lloydminster and thence to Ottawa, where we arrived on December 1.

APPENDIX No. 23.

ABSTRACT OF THE REPORT OF L. E. FONTAINE, D. L. S.

INSPECTION OF CONTRACT SURVEYS IN WESTERN ALBERTA.

I left Edmonton on February 22, 1911, for Entwistle, which I made a base of operations for the examination of survey contracts Nos. 15, 29, 30 and 31 of 1910, and the re-examination of contract No. 22 of 1909.

I next performed some corrections in contract No. 16 of 1909, and opened the necessary section lines to define timber berth No. 1727, in townships 48 and 49, range 6, west of the fifth meridian, which work was finished on August 25.

Leaving for Edson, which I made my base for further work, I proceeded with the inspection of survey contracts Nos. 22, 23, 27 and part of 28 of 1911. I then returned to Gainford, stored part of the outfit and left for Edmonton, arriving there on November 23.

On December 2, after purchasing supplies and securing transport outfit, I returned to Gainford and proceeded with the inspection of survey contracts Nos. 21, 24 and the addition to 22.

This work being finished I returned to Edson on February 10, 1912.

APPENDIX No. 24.

ABSTRACT OF THE REPORT OF J. FRANCIS, D. L. S.

SUBDIVISION SURVEY IN THE WESTERN PART OF CENTRAL ALBERTA.

After organizing my party at Edmonton I left for Bickerdike on April 14, 1911, and from there followed the trail along the valley of the west fork of Embarras river.

On account of the lateness of the season and the scarcity of horse feed we did not reach our starting-point, township 45, range 23, west of the fifth meridian, until May 12. The northeast portion of this township lies between the main ranges of the Rocky mountains and an outer range which I have named the 'McLeod Mountains.' This latter range or spur, branching from the main range near the northwest corner of township 46, range 24, runs in a southeasterly direction to the centre of township 45, range 21, and through range 22 and part of range 21 it forms the divide between the Atlantic and Aretic waters. Between these ranges lies a very hilly country, the slopes being generally wooded, while the intervening valleys have narrow openings, generally more or less muskeg, with creeks of the finest water running through them.

In this part of the country coal seems abundant, as it is here that all leasing and development work has been done. The coal was visible in many places in these hills, principally in the creek beds, and scars and gulches of the hillsides.

The continental divide, which is a bare stony ridge, enters township 45, range 23, on section 25, passes westward and merges into the mountain range on section 20. It continues from there northwesterly one or two miles, rounding the headwaters of the north branch of Brazeau river, then turning south and southeasterly, divides the waters of Rocky river from those of the Little Brazeau.

The southwestern part of this township lies amid the rocky peaks and bald mountains of the first northeastern range of the Rockies.

The south part of the township is drained by the north branch of the Brazeau, while the northern two tiers of sections are drained by the south branch of McLeod river. This latter branch is made up very quickly by numerous creeks seeping from the hillsides and flowing in every direction.

Sections 27, 28, 35 and 36, contain small bodies of spruce and pine timber fit for railroad ties. This grows principally along the slopes facing the south, while those slopes facing the north grow stunted spruce and balsam of no value.

This scanty growth is undoubtedly caused by the ground remaining frozen to some extent during the entire year.

On and near the centre of section 33, along McLeod river, the Mountain Park Coal company are erecting their mining camp buildings and propose to mine coal at an early date.

The spur line of the Grand Trunk Pacific is surveyed as far as this section and is at present under construction. This spur line joins the main branch near the Yellowhead mines in township 49, range 21. A portion of section 36, and of the adjoining section 1, township 46, range 23, which have been surveyed by Mackenzie and Mann as coal claims, were retraced. Some prospecting work has been done and as far as could be seen excellent coal abounds through these sections. The south part of township 46, range 23, which I subdivided, contains the McLeod range of mountains, the middle of this range passing from east to west through the township near its centre. The highest hilltops are bare and rocky, being from 1,500 to 2,000 feet above the valleys. The south slopes are in some places wooded with timber of no great value. Numerous creeks, gulches and ravines cut this range in every direc-

tion making the township very rough and broken. Branches of McLeod river in ranges 22 and 23, pierce the mountain range and drain the northeastern slope of the next range of the Rockies.

Near the east boundary of the northeast quarter of section 24, township 46, range 24, two branches unite to form the main branch of McLeod river, one coming from a southeasterly direction, the other and larger branch coming from the west, this latter branch continuing west for about six miles where it divides up into a number of creeks. The railroad survey follows the branch which comes from the southeast and continues for about five miles up the stream.

The portion subdivided in township 46, range 24, lies between the McLeod mountains and the mountain range separating the McLeod waters from those of Rocky river. The portion still unsurveyed is bald, rough and mountainous, with no timber and apparently no minerals. Numerous creeks which have their sources in the mountains on the east side of range 25, join together on section 30 and form the west branch of McLeod river which flows easterly through the township. This river is about one chain in width with water from one to one and a half feet in depth, the current, as usual with mountain streams, being very swift with numerous little falls and rapids. Where the river does not pass through rock formation, the bottom is often spread out, the stream often occupying a very small portion of its bed.

The heavy slopes facing the river are timbered with spruce, pine, and balsam, that growing on the north slopes being small, stunted and of no value. The timber growing on the south slopes, more especially through the centres of sections 28, 29 and the east half of 30, is fairly well grown and is large enough for ties or sawlogs. My estimate of this strip is fully one million feet.

Pack-trails following up McLeod river give access to all the three townships in which my work lay, while an alternative one following up the north branch of Brazeau river and crossing the divide in township 45, range 23, reaches the head of the south fork of McLeod river. After next season the railroad will enable prospectors, tourists and visitors to easily reach this part of the country where a delightful month of cool weather can be experienced at any time during the summer. Owing to the rivers in those townships surveyed not being large, little power could be obtained from them during the winter.

Game was not plentiful in this part, a few bears and several flocks of mountain-sheep being all that was seen. Fish of the trout variety were obtained in the north branch of Brazeau river and the west branch of McLeod river. The soil is good only in very small patches, and in no place is it fit for agricultural purposes.

It is well that these townships have been placed in the forest reserve as the summer frosts and short season preclude the growth of any cereal crops; also there is no hay and very small areas of pasture. Mountains of limestone with sandstone and shale make up the rock formation.

Several small patches of timber on favourable slopes will yield sufficient ties to equip the railroad which is being built and to supply pit props for all the mines which may be worked.

On September 22, in eight inches of new snow, we left for Brazeau river, reaching there on the 26th, after cutting pack-trail for one day.

From this date until the end of October the weather was splendid, being the only lengthy spell of good weather we experienced during the whole season. In township 44, range 20, west of the fifth meridian, sections 5, 6, 7, 8, 17, 18, 19 and 20 were surveyed, and the east outline of the township was resurveyed. The western tier of four sections is generally wooded with green timber of medium size, while the rest of the township surveyed was covered with small pine, spruce and brule. These sections are hilly, being made so by Thistle river and its tributaries which flow eastward into the Brazeau. Along the east outline sections 13 and 24 contain some timber of fair size which continues into range 19 and seems to extend far enough to make four or five square miles of very good merchantable timber. The soil in this township is poor,

and the open places, being generally muskeg, afford no pasturage or hay. In township 43, range 20, sections 11, 12, 13 and the south half of 14, are still covered with green timber consisting of pine and spruce, generally small but containing a large number of trees fit for lumber and railroad ties. The north part of the township is covered with brule and second-growth scrub pine, while the greater part of the south half is still green and unburnt, the green timber extending into township 42, range 20.

The northeast corner of the township, on the outline, is near the centre of the northwestern end of the Bighorn range, and is nearly 1,000 feet above Brazeau river. The east boundary of sections 1 and 12 runs along a comparatively level bench and is all in green timber.

The soil in township 43 is similar to that in township 44, the climate not being suitable for agriculture on account of summer frosts and the shortness of the season Those townships can only be reached by pack-trail, from the north via the Pacific Pass mines, from the south via Banff or Laggan and across Saskatchewan river, or by trail up the Saskatchewan and Brazeau rivers. Brazeau river runs northerly through those two townships; its valley, cut through rock formation, is very narrow and deep, being about five to six chains wide at the top and one to two chains at the bottom, with a depth of from 100 to 150 feet. The river has a swift current and is from two to three feet deep. Dams could be constructed and power obtained in every mile of its course, the water supply in winter, however, being much less than in summer.

APPENDIX No. 25.

ABSTRACT OF THE REPORT OF A. H. HAWKINS, D.L.S.

SURVEY OF THE TWENTY-SECOND BASE LINE WEST OF THE FIFTH MERIDIAN.

On March 22, 1911, our party left Edmonton for Wabiskaw via Athabaska Landing, arriving there April 3. We then moved to Horse lakes where my cache had been placed and storing the sleighs there we used a pack-train for the remainder of the journey. Deep snow detained us for several days, but we finally reached the intersection of the fifth meridian and the twenty-second base on April 25.

The following day we began the production of the base, and on September 22, 1911, having completed it to the east boundary of range 21, we started on our return trip to Edmonton via Peace River Crossing, Grouard and Athabaska Landing.

Throughout the season very wet weather prevailed, rain having fallen upon ninety days, between April 25 and October 1, so that we lost about twenty days, on account of rain, and the constant moisture kept the ground soft, making trail cutting and travelling a very serious matter. During the early part of the season cloudy weather interfered very much with the observations.

The country from the fifth meridian to Peace river and south to the twenty-first base line is all very similar in character, and might very well be described as a gently rolling surface, covered with poplar, spruce, willow and alder, with forty to fifty per cent of swamp, marsh and muskeg and numerous small lakes, most of which are rather marshy along the shores. A number of creeks, usually small, flow to every point of the compass, as the country is the height of land for waters flowing south and east to Wabiskaw and Bear rivers, north to Loon and Lubicon lakes, and west and northwest to Peace river. No hills of any account are to be found in this locality, the so-called Cadotte mountains and Horse hills being not more than one hundred feet above the general level of the surrounding country. Horse hills lie in ranges 2 and 3, and are covered with a very heavy growth of poplar and spruce timber. In fact the best timber seen throughout the whole line is, I think, to be found on these hills. The poplar would measure from three to thirteen inches in diameter and the trees, running from thirty to fifty-five feet in length, are clean and sound. The spruce would measure six to twenty-two inches in diameter, fifty to seventy feet in height, and would without doubt make excellent lumber.

The extent of this area of timber is not great, being about seven to nine miles in an east and west direction and from one to three miles in width, and on account of the scarcity of timber fit for milling in this locality this should be reserved for the settlers.

There is a small amount of timber to be found along the south shore of Lubicon lake, but it is only in patches and does not compare with that on Horse hills, there being a very considerable amount of shaky and punky timber. The same remarks apply also to the timber on Cadotte mountains.

The timber is generally very light and the land could be easily cleared as the stumps of the poplar and balm of Gilead decay very quickly once the tree is cut. There is, I think, quite enough timber for the settlers' use but nothing to warrant commercial lumbering, as wood is the fuel that settlers in this district will probably have to depend upon at least for some time.

At present it is a rather difficult matter to get into this country as the only summer roads are the pack-trails and, in a wet season, these are generally very poor and could scarcely be called roads. A sleigh road leads from Fish camp on Athabaska

river about forty-five miles up-stream from Athabaska Landing which may be travelled on the ice from Calling lake, Rock Island lake, Wabiskaw and Trout lakes, or from Wabiskaw, Wabiskaw river may be followed as far as it may be desired to go towards Peace river.

The twenty-second base line crosses the trail about two and a half miles northwest of Horse lakes, in range 3, section 31. The summer trail into this country passes somewhat farther west keeping close to Trout river, and crossing the line in range 4. This trail passes through some very good land. In fact I think the country in the Trout river valley is well adapted for settlement as large portions of it are comparatively open and support a very excellent growth of grass, vetches and pea-vine.

To reach the country in the vicinity of Lubicon lake about range 13, one could go by Grouard, thence to Whitefish lake trading post by the wagon road, and from this point by a sleigh road to Lubicon lake. It is reported that a good summer pack-trail extends north to Buffalo lake.

While there are many muskegs, and marshes, the country from range 11 to Peace river is said to be good, the soil is excellent and around Lubicon lake are many open patches and places that would require but little effort to make them ready for cropping. Large amounts of hay are put up by the Indians in the vicinity of this lake and a number of Indians have their winter houses about three-quarters of a mile south of the lake and own a herd of fifty or sixty head of rather fine cattle which were in excellent condition.

The country in ranges 19 and 20 is comparatively open having been burned over and is now largely covered with scrub and brush, easily cleared. In many places good tracts of hay, redtop, pea-vine and marsh grasses grow and the district would make an admirable cattle or horse range. A large tract might very easily be brought under cultivation with a small amount of clearing.

This locality is accessible from Peace River Crossing by a pack-trail which is rather rough and broken as several very deep ravines leading to Peace river have to be crossed in order to reach the open country. In all probability, however, those lands to the west of the river will prove to be more attractive to the settler as they are more easily reached and the country seems to be more open.

A fine tract of country lies between Peace River Crossing and the small prairie extending two or three miles south to the twenty-first base line. Since this line was run, in the spring of 1910, five or six settlers have settled on the small prairie north of the base line. They had very fair crops and comfortable-looking houses and stables.

Game consisting of bears, moose, spruce-hens and willow and ruffed grouse was fairly plentiful throughout the whole of the country crossed by this base line. A few ducks and geese were seen on the larger lakes, and in range 10 a large colony of beaver were noticed.

Muskrats were quite numerous, but mink, foxes and wolves were very scarce. Rabbits appeared to be more numerous than for several years past. Fish were reported as being plentiful in Trout river and whitefish as being abundant in Lubicon and Cadotte lakes.

Hay was plentiful throughout the length of the line and little or no trouble in finding horse feed was experienced after June 1. The best hay meadows were seen in range 10, from four to six miles north of the base line, and in the vicinity of Lubicon lake. Neither minerals of economic value nor coal was found.

Summer frosts will probably prevail in this country until settlement is well advanced and the numerous marshes and swamps drained.

There is probably ten to fifteen per cent more muskeg east of range 10 than was found to the west of this point and the western portion of this locality is probably the best adapted for settlement.

The soil varies from sandy loam to heavy clay loam, and but comparatively little sandy land was seen, the clay loam and humus seeming to prevail.

The country along the base line is fairly well adapted to mixed farming once communication with markets is established, as the soil is fertile and easily cleared Cattle and horses thrive during the summer on the native grasses. Wood for building and fuel is everywhere abundant and water is plentiful throughout the entire locality.

APPENDIX No. 26.

ABSTRACT OF THE REPORT OF G. H. HERRIOT, D.L.S.

SUBDIVISION AND TOPOGRAPHICAL SURVEY NEAR PRAIRIE CREEK.

From Prairie Creek we travelled by a freight road to township 49, range 27, west of the fifth meridian. Our work in this township was the completion of the subdivision of the southern portion in so far as it was deemed practicable.

The land in the part subdivided lies mostly in the valley of the Athabaska, and is in part almost level or gently sloping. The most southerly row of sections, however, is broken by Folding mountain and Fiddle Creek range. The valley of Athabaska river to the south is well wooded with spruce and jackpine. The soil is a light sandy clay, and does not produce a very luxuriant growth.

Having completed the work in this township we proceeded with the subdivision of the land lying in the valley of Fiddle creek and its tributary Sulphur creek, extending our lines from the thirteenth base line as far south as the not springs located in section 8, township 48, range 26. The subdivision thus includes a portion of townships 48, ranges 26 and 27.

The subdivision being completed about August 20, we proceeded with the work of obtaining sufficient data for the construction of a topographical map of the land in the vicinity of the hot springs. The map was to be on such a scale, and to cover such an area, that it would be possible to project thereon a system of roads, and a water-distribution service. The chief road was one from the hot springs to the railway, and the water distribution service to be such that water might be carried to the Grand Trunk Pacific hotel site near the railway and also to the site of a small chalêt in close proximity to the springs.

The area covered by the topography might be described as a narrow belt extending along both sides of the valley of Sulphur creek from a little south of the hot springs to its junction with Fiddle creek, and thence as a similar strip along Fiddle creek. Three main traverses were run, one along the bed of Sulphur and Fiddle creeks, and one along each side of the creeks a short distance up the hillside. Occasionally it was necessary to cover some small area by a subsidiary traverse. Levels were carried from a bench-mark on the Grand Trunk Pacific railway near the Jasper Park collieries, along the old pack-trail, to Fiddle creek, and thence up Fiddle and Sulphur creeks to the hot springs.

On October 21 a point was reached about a quarter of a mile north of the north boundary of section 24, township 48, range 27, and as the weather was becoming too cold for sketching and slide-rule work we confined our traverses to one along the new pack-trail, and another along the bed of Fiddle creek to its junction with Athabaska river.

The country covered by our subdivision and topographical survey is rather rough, being cut by several deep V-shaped valleys. It is, moreover, everywhere covered with heavy windfall making travel very difficult. Fortunately in the summer of 1910 a kind of pack-trail was opened from the end of the Jasper Park collieries wood trail up as far as the hot springs. This trail although very rough, passing as it does through several small muskegs, across three of the deep creek valleys and in places along the rough stony beds of Fiddle and Sulphur creeks, was of great value to us.

Also about midsummer under the directions of the Dominion Parks commissioner, a better pack-trail was opened from the wood trail before mentioned to the hot springs. This trail is very good and is moreover very picturesque. It follows along the west



Photo by G. H. Herriot, D.L.S.

Sulphur Creek in Jasper Forest Park Reserve, showing Travertin Boulders formed by deposits from Hot Springs.

side of Fiddle creek from Morris creek to a point near the mouth of Sulphur creek, and from there it follows the west side of Sulphur creek to the hot springs. Perhaps the most beautiful scenery met with, is where the trail meanders along the edge of the bench above the Sulphur creek canyons, which, although not more than one hundred feet deep, are very beautiful.

The greater part of townships 48, ranges 26 and 27, is broken by mountains, the main ones being Fiddle Creek range, Folding mountain and the range of which Roche Miette is a part. Fiddle Creek range is a very prominent limestone ridge which seems to have been thrust up so that the strata appear to be almost standing on edge. Fiddle creek cuts through it in two or three places, forming deep narrow canyons. The grandest of these is situated in section 2, township 49, range 25, and is not more than two miles from the Grand Trunk Pacific railway.

Fiddle creek, the main stream in this area, flows in a northwesterly direction across the townships before mentioned, and empties into Athabaska river at the south end of Brule lake. It is a small stream from twenty to thirty feet in width, with a current of from six to nine miles an hour, and is essentially a mountain stream, in that it follows a winding course along a wide boulder-strewn bed. In periods of heavy rain or rapid melting of the snow on the mountains it becomes greatly swollen carrying with it gravel and boulders. So incessantly has it been carrying debris of every description into the Athabaska, that a large fan-shaped deposit has been formed at its mouth, thus forcing that river close against the rocky bank on the north side, and gradually filling the southern end of Brule lake. In the short distance our subdivision extended, three main tributaries were met with, all occurring on the west side, and in order of occurrence as you travel up-stream are known as Morris, Villeneuve and Sulphur creeks.

From a scenic point of view, Sulphur creek is by far the most important. It enters Fiddle creek in section 19, township 48, range 26, and from there follows a winding course through sections 18, 17 and 8. In section 18 it is joined by a branch stream from the west that is known as the west branch of Sulphur creek. This stream is quite small, being only about fifteen or twenty feet wide. It has a very rapid current, and on one stretch it is very tortuous, winding back and forth in serpentine curves. In this part it has cut a narrow canyon with walls about one hundred feet in height which are almost vertical.

About one and three-quarter miles up the east branch of Sulphur creek at the centre of a broken anticline in which the limestones are standing at a high angle the hot springs are to be found. The hills on either side rise to about one thousand feet above the bed of the creek, and low down in the valley almost on the level of the creek are the hot springs, four large ones and several lesser ones. The many large boulders of travertin found higher up the slope would indicate that at one time the springs issued much higher up the hillside.

The fissuring through which the springs emerge extends for a distance of about 200 feet. The temperature of the main springs ranges from 112 degrees Fahr. in the coolest to 128 degrees Fahr. in the hottest although observations made this summer indicate that the temperature varies slightly with the weather conditions, and especially after a heavy rainfall. The water is charged with gases that give off a smell of sulphur, and the water is quite sulphurous to the taste. From an attempt made to guage the flow of the several springs, it was estimated that the approximate discharge is about one hundred and fifty gallons per minute. It was a rather difficult matter to guage the flow as in some places the water breaks through the loose boulders at the edge of the creek bed.

A sample of the water was submitted to the chemist at the Experimental Farm. His report shows that sulphates of lime and magnesia form the larger part of the dissolved solids, and are the materials that are being deposited by the springs.

Following the same line of faulting southeast there are found several large springs, but none that could be called hot springs. They are all depositing large quantities of lime and magnesia and may be found to be of medicinal value.

The sides of the valleys are covered with much standing dead pine and spruce from six to thirty inches in diameter, while the ground itself is covered with a heavy windfall of this dead timber varying from two to eight feet in depth. A second growth of young jackpine has sprung up almost everywhere. In sections 13, 14 and 23, township 48, range 27, however, there is a nice area of live spruce from eight to twenty inches with a few balsam averaging eight inches in diameter. At present, however, this timber is practically inaccessible. The Jasper Park collieries have been using great quantities of the sound dead timber for props in their coal mine.

The soil is mostly of a sandy boulder clay, in some places being covered with a slight depth of vegetable mould. The dead timber would indicate its richness. It is not suitable for agricultural purposes on account of its roughness and the immense amount of clearing necessary, and as a grazing country it is at present impossible, as an animal cannot stray a dozen feet from the pack-trail owing to the windfall. We were occasionally forced to send our horses out to the few suitable grazing areas that occur in that section, as they could not always find feed convenient to our camps.

In section 6, township 49, range 27, is the mouth of the tunnel of the Jasper Park collieries. Several outcrops of coal seams are to be seen on Morris, Villeneuve and Mountain creeks and the company are extending their workings as rapidly as possible.

In this area the climate is that characteristic of the eastern slope of the Rockies. The summer season from May until September is essentially the rainy season, as scarcely a day passes without at least a shower.

It is indeed unfortunate that the half-breeds and Indians made a final slaughter of the game in this section just prior to its being set aside as a natural park. During our sojourn in the park we saw very few wild animals and few signs of their presence. Five or six deer, three black bears and a few partridges were all that were seen. The heavy windfall is of course a great drawback to the country as a game preserve. Athabaska river is but sparsely stocked with pike and rainbow and bull-trout, and the smaller mountain streams are probably too swift and rocky to carry even the mountain trout. The park authorities however exercise a very strict patrol, and it should be a matter of but a few years till game again becomes plentiful.

It is not unlikely that these springs have been known to the Indians for many years, and that they made frequent pilgrimages there with their sick and ailing. Old pack-trails that lead towards the springs can be followed for short distances, and old teepee poles are still to be seen in the neighbourhood. A rude basin has also been shaped so that the water from one of the outlets flows into it.

The area to which this report has especial reference has been set aside as a national park, thus ensuring to the people of Canada, a heritage that may become one of the greatest health and pleasure resorts in the whole land.

The greatest need of this area, if it is to become an important health resort, is a good wagon road from the railway to the hot springs. Two routes are possible. The first of these would leave the railway near the Jasper Park collieries and climbing over the hills to Fiddle creek, would follow the west side of Fiddle and Sulphur creeks to the springs. This would necessitate the crossing of several small muskegs, the deep valleys of two or three tributary creeks and the overcoming of some rather heavy grades. It would moreover, before Fiddle creek is reached, lead through a strip of country devoid of scenery.

The second and better route would lead from the railway along the east side of Fiddle creek as far as the Grand Trunk Pacific hotel site. From there the road would take a long loop to the southeast gradually rising up the east slope of Fiddle Creek range until a suitable altitude is reached, when it would switch back still following the east slope of the ridge in a northwesterly direction, and climbing

steadily to a point directly above the canyon on Fiddle creek. From this point the road would cut along the edge of the limestone ridge, following along a contour until the canyon is passed, thence gradually descending to the first bench above the creek bed on the east side. This bench would be traversed until Sulphur creek is reached where it would be necessary to cross Fiddle creek on a bridge. From there the east slope of Sulphur creek would be followed to the hot springs. Such a road would be both expensive and difficult to construct. It would also involve some rather difficult engineering problems at the Fiddle creek canyon. As has been previously pointed out, the canyon is formed by Fiddle creek cutting through a limestone ridge in which the strata are standing almost vertical. Immediately to the south of this ridge and on both sides of Fiddle creek is a very soft stratum about one hundred feet in width. The soft stratum has been so eroded as to leave a wide gap between the nose of the ridge and the bench to be reached beyond the canyon. It may be possible to cut a road along the almost vertical face of the limestone to a point where a short bridge could be constructed across the gap before mentioned. Once the bench to the south has been gained it would simply be a matter of following a course that would entail the least cost of construction. Although the first cost of constructing this road would be much higher than that of the other road, it would have a decided advantage in length and in the less cost of maintenance. The up-keep would depend only upon the few loose rocks that might come down, and the occasional falling trees; while the other route would have the disadvantage of muskegs, a longer stretch of trail that would continually be obstructed with falling timber, and possibly two more bridges to keep in repair. Moreover the canyon road would have the decided advantage of having very much finer scenery along its route.

Adjoining the proposed site for the new Grand Trunk Pacific railway company's hotel in this district and immediately to the north of it is a fine gently sloping area that is eminently suited as a townsite. This area is dry, slightly wooded and has a very fine outlook towards Athabaska river and the mountains beyond. Also a few villa lots could be laid out in the immediate neighbourhood of the hot springs, for on the right side of Sulphur creek, about a quarter of a mile from the springs and just above the first slope, a small gently sloping bench is found. Moreover, a small stream rises in the upper part of the bench and could be used as a regular source of water supply. The altitude of the bench is such that water may be piped directly from the hot springs to bath-houses erected there. Furthermore, although the valley of Sulphur creek about the upper springs is quite narrow, right at the lower spring the valley widens sufficiently to allow room for a good sized bath-house.

It is hoped that it may be possible to pipe the water from the hot springs to the Grand Trunk Pacific hotel site and bath-houses to be erected near it. In this connection it may be pointed out that at Banff the water at a temperature of about 102 degrees Fahrenheit is piped a distance of about 4,640 feet with scarcely any appreciable loss in temperature. The pipe is wrought-iron and is protected from the weather by being properly packed about with moss in a wooden box two feet square. The velocity through this pipe would of course be quite rapid as the fall is 460 feet from the inlet to the outlet at the storage reservoir. The loss of temperature would however depend upon several factors, namely, the weather conditions, the protection of the pipe, the diameter and length of the pipe, the velocity of flow, and also on the fraction of the cross-section of the pipe the water occupies. Under the most favourable conditions it is reasonable to expect that the water at a mean temperature of 118 degrees Fahrenheit may be piped from the Sulphur creek springs to the site before mentioned, with no greater loss of temperature than 8 or 10 degrees. The length of pipe would probably require to be about seven miles, and the fall in that distance would be about 1,200 feet or about an average fall of 170 feet per mile. In regard to piping water to the villa site, the length of pipe would not exceed 1,500 feet and the loss of temperature could be made practically negligible.

APPENDIX No. 27.

ABSTRACT OF THE REPORT OF E. W. HUBBELL, D.L.S.

RESURVEYS AND INSPECTION OF CONTRACTS IN SASKATCHEWAN.

We left Prince Albert on May 1, 1911, and arrived at Shellbrook the following day. This is a place of about 350 inhabitants and has a new creamery, a branch of the Bank of Commerce and two elevators, as well as graded roads and sidewalks. The Canadian Northern Railway company is extending its line from here to Battleford. The line is already in operation as far as Blaine Lake, a daily service is inaugurated between Shellbrook and Prince Albert and great quantities of lumber and wood for fuel are conveyed daily from Big River to Prince Albert, a distance of about one hundred miles. This section of the country is well settled and produces lumber, fire-wood, wheat, oats and vegetables.

At Mistawasis, in the Snake Plain Indian reserve, we were delayed for a day by the immense bush fires which raged for several days, destroying great tracts of timber through this section of the country, as well as several houses and stacks of hay.

My first work was the resurvey of township 46, range 5, west of the third meridian, which we commenced on May 9, and finished on June 5.

The surface of this township is undulating, while poplar and willow clumps alternate with open patches of prairie. About 80 per cent is admirably adapted for agricultural purposes. The soil in general is sandy loam and is suitable for the production of wheat, oats, flax and vegetables. All the homestead lands are taken, many being patented, and most of the railway lands are disposed of. A considerable portion of the township is under cultivation, and many of the farms and buildings are very fine. Plenty of wood for fuel is obtainable, but the standing timber is scarcely of merchantable dimensions. The various small lakes furnish a permanent and ample supply of fresh water for stock, and good drinking water is obtained from wells twenty to thirty feet deep. In a large part of the township the sections are fenced, the road allowances are graded and bridges are built where necessary. The surveyed trail from Duck Lake to Green Lake crosses this township and was connected with our survey lines. Skipton post-office, situated in the southwest quarter of section 22, has a semi-weekly mail service from Duck Lake, a place about twenty-six miles distant. The new branch of the Canadian Northern railway from Prince Albert to Battleford passes within a mile of the north boundary of the township.

Marcelin, a small but growing village about six miles west, on the railway, is the nearest place of business. It is the centre of a prosperous agricultural district and at present shows every indication of unusually rapid advancement This section of the country is admirably adapted for mixed farming, and has all the requisites for the new settler.

From Marcelin we proceeded to Meeting lake, following the old Jackfish trail. The trail is now ploughed up in many places, showing the rapidity with which this section of the country is being settled. New houses are being erected in every direction and the country in general has made a marked advancement during the past year.

We reached townships 48 and 49, range 10, and township 49, range 11, west of the third meridian, of contract No. 6 of 1910, on a fairly good trail from Meeting lake, which goes via Witchekan lake to Green Lake. The soil in these townships is in general black loam, varying in depth from three to ten inches, with clay subsoil; in some places, however, sandy loam with gravel is found. The surface is slightly

rolling and is thickly covered with poplar four to twelve inches in diameter, willow, a little birch and some scattered clumps of spruce. Both poplar and spruce are suitable for building purposes. There appears to be a scarcity of hay marshes, although willow swamps are numerous, and there is little, if any, open land and no settlers. Altogether this portion of the country in its present condition is not well adapted to settlement. The nearest express office is North Battleford on the Canadian Northern railway about seventy miles distant, and the nearest post-office is Mullingar distant about fifteen miles.

We finished the inspection of this contract on June 15, and the following day left for Prince Albert, passing, en route, through the Doukhobor villages, crossing Saskatchewan river at Carleton ferry (where the old-time ferry is still in operation), from there to Duck Lake and Macdowall, and thence to Prince Albert, arriving there June 24. Duck Lake is a small town on the Canadian Northern railway. It does not show the usual signs of advancement compared with other towns in this part of Saskatchewan, but on the contrary it seems to be just where it was ten years ago. To a considerable extent this is due to the fact that Rosthern, a small but thriving town on the same railway about eleven miles to the south attracts most of the trade from the surrounding district, it being one of the centres of the greatest wheat growing section of northern Saskatchewan. While passing through the Doukhobor villages, a decided improvement was noticeable in these people, the one time 'Community system' is practically non-existent, and the Doukhobors now appear as prosperous farmers, while their crops, when we saw them about June 20, were excellent, the wheat being then about eighteen inches high. Though they still retain many of their old customs they are gradually becoming Canadianized.

After repairing the outfit and replenishing our supplies we moved via Macdowall to township 45, range 27, west of the second meridian, to resurvey the northern third of this township. This work was commenced June 30 and finished July 15.

The surface of this portion of the township is undulating to rolling, with bluffs of poplar around the numerous lakes and ponds; there is also considerable underbrush. In these bluffs the poplar runs to twelve inches in diameter and is suitable for building purposes. The soil, in general, is black loam averaging about eight inches in depth, with a clay subsoil, and is admirably suited for the growing of grain and vegetables. There is an abundance of good water. Many of the road allowances throughout this township are graded and bridges are built where necessary. In addition to this there are a number of excellent trails which radiate in all directions. All the homesteads in this township are entered for and a fair portion of the land is under cultivation, wheat, oats and vegetables being the principal products. The nearest post-office and village is Macdowall situated on the Canadian Northern railway about seven miles distant.

This district is well adapted for mixed farming. Great quantities of fire-wood are cut in this vicinity and shipped by rail via Macdowall to the various cities and towns in northern Saskatchewan.

My next work was the subdivision of a portion of township 52, range 16, west of the third meridian, distant by trail about 140 miles. In this portion of the country great progress in agriculture is apparent in all directions, houses and fences are being built everywhere, and large areas of land are under cultivation. This progress is more noticeable in the vicinity of Blaine Lake where there are two Doukhobor villages. These Doukhobors no longer live in communities but cultivate the land and act independently of each other. The results are infinitely superior to their original methods and in a few years it will be difficult to find a more thrifty class of settlers. The extension of the Canadian Northern railway from Shellbrook to Battleford passes close to Blaine Lake and when finished will be of incalculable value to this section of the country. There is much vacant land in this vicinity, mostly prairie and, judging from the crops raised by the Doukhobors, it must be of excellent quality, although in places both land and water are alkaline.

We arrived at this township on July 26, and camped in section 1, on the shore of Birch lake, a beautiful and extensive sheet of good, clear water containing several small wooded islands.

We commenced this work July 27, and finished August 3, during which time, we also traversed the west shore of Midnight lake and another large lake situated in the western part of this township. Jackfish, whitefish and sucker are found in both these lakes.

The southern portion of this township is level, some of it is open prairie and scattered hay meadows, and the remainder is covered with poplar ranging from two to ten inches in diameter, and willow, but much of this timber has been fire-killed. The soil is black loam averaging about eight inches in depth with clay subsoil. There are, however, several small patches of sandy country. Plenty of wood is available for fuel, but there is scarcely any fit for building purposes and none of commercial value.

The lakes above mentioned have large hay meadows along their shores from which great quantities of hay are cut annually by the several ranchers in this vicinity. There are a few settlers with first year crops, and the country to the south and east is filling up rapidly. The nearest post-office is Glenbush, about twenty miles south, and North Battleford is the nearest express office, railway station and business centre. There is a weekly mail service between these two places.

On August 4 we left Midnight lake and proceeded by a good trail to Turtle lake to inspect contracts Nos. 15 and 16 of 1911, in the Meadow Lake district. These contracts consisted of townships 58, 59 and 60, ranges 17, 18 and 19, townships 57, ranges 17 and 18, and township 56, range 17.

East of Turtle lake we passed a fairly large lake, around the shores of which are a number of settlers. The country through which we passed is hilly in places and fairly well wooded with poplar and willow. We camped for the night at Turtle lake, where there is a general store having limited supplies. Turtle lake is one of the prettiest and largest lakes in this section of country. It is about twenty-two miles long and in places, five miles wide. The water is very clear, pure and excellent for drinking, while jackfish, whitefish and sucker are plentiful. Great quantities of fish are salted, dried and kept for winter use. There is a fine sandy beach surrounded by some excellent timber suitable for building purposes.

From here we proceeded in a northerly direction past the northeast corner of Brightsand lake, which is another fine body of water, surrounded by timber. The trail we travelled is the one in general use to Meadow Lake in summer, and although roundabout, is preferable to the new trail, which has recently been made from Battleford to Meadow Lake in range 17, when the frost is out of the ground. This new trail when finished will be much shorter than the one now travelled, and a great boon to intending settlers in the north. The Meadow Lake country is one of the finest tracts of unsettled country in Saskatchewan. The surface is, in general, level except in township 56, range 17, and the soil is black loam suitable for the production of wheat, oats and vegetables. The timber, on the whole, is of comparatively small dimensions, although in places it is sufficiently large for manufacturing purposes, especially in the northern townships. There are numerous openings, more especially in townships 59 and 60, range 17, admirably adapted for immediate settlement. Meadow lake, situated in township 59, ranges 16 and 17, is a fairly large sheet of fresh water surrounded by hay marshes. Meadow, Makwa and Rabbit rivers and several large creeks with a few small lakes furnish an ample and excellent supply of fresh water. Hay and fuel are plentiful. Indian Reserve No. 105, about four miles square, adjoins Meadow lake. A large band of Indians live here and a small store is kept by a Mr. Morin, which supplies a limited quantity of provisions. Most of the freight is brought in via Green Lake about forty miles distant, on a fairly good trail, although at high water there is some difficulty in crossing Meadow river. Game and fish are plentiful. In this district large black timber-wolves are seen; they are very savage at certain times of the year and will then unhesitatingly attack a man. There is a post-office

here with a monthly mail service from Green Lake. This fine country, with its many natural resources, will undoubtedly in a short time be the centre of an extensive settlement. It is an ideal mixed farming district and lacks only railway communication to make it one of the most desirable places for settlement and ranching in Saskatchewan. Upon the completion of our inspection we returned to Glenbush via Midnight lake by the new road, previously mentioned, in range 17. We experienced considerable difficulty crossing our outfit over some of the floating muskegs, having to corduroy several places, pack our complete outfit across on our backs, and haul our wagons through by hand. Our next work was the inspection of contract No. 13, 1911, comprising townships 50, 51 and 52, range 11, and townships 52, ranges 12 and 13, west of the third meridian, which we commenced on September 6. We reached this contract via the old Buffalo lake trail from Glenbush. The soil in general is black loam with clay subsoil, suitable for the production of wheat, oats, barley and vegetables. The surface is level, with the exception of township 52, range 13, which is slightly rolling and is covered, for the most part, with small poplar and willow, although in township 52, range 13, and the southern half of township 50, range 11, there is some larger poplar and scattered clumps of spruce and jackpine, but not in sufficient quantities for manufacturing purposes. There are numerous open patches and hay sloughs, and the land around Witchekan lake, from which hundreds of tons of hay are obtained annually, is low and marshy. Witchekan lake occupies the greater part of township 51, range 11, and is about five miles across at its widest point. There are several large creeks flowing into and out of this lake which abounds with jackfish and sucker. The water is not good for drinking. Quantities of fire-wood can be readily obtained in these townsihps. We did not observe any indications of coal, lignite veins or minerals. There are several ranchers around Witchekan lake who own large herds of cattle, this country being admirably adapted for ranching. There are no other settlers, although much of the land is excellent for homesteading. A band of Sioux Indians have established a camping ground on the north end of the lake and have been residing there for a number of years. They are most desirous of obtaining a portion for a reserve and have several shacks and numerous teepees in which they live the whole year. Glenbush is the nearest post office, and has a weekly mail service from Battleford about fifty miles distant, while the nearest railway is the Big River branch of the Canadian Northern railway. There are trails radiating in every direction from Witchekan lake. From here we proceeded via the Green Lake trail, to township 53, range 9, a portion of contract No. 11, of 1911, and inspected nine miles of line, but owing to unfavourable weather conditions we were unable to obtain an astronomical observation. This portion of the country is heavily wooded and hilly.

Our next work was the inspection of contract No. 10, of 1911, comprising townships 53, 54 and 55, range 6, and townships 54 and 55, range 7, west of the third meridian. We entered this contract from the south on a good trail branching from the Green Lake trail, which leads to the Big River sawmills situated on Cowan lake. The surface throughout is level to rolling and is covered with poplar, jackpine, spruce, birch and willow, a small percentage of which is suitable for manufacturing purposes. There are innumerable small lakes and hay sloughs in every direction. Big river averaging about two chains in width and being quite deep in places passes through townships 54 and 55, range 7, and is utilized for the conveyance of sawlogs from various lumber camps to the Big River mills. There is but little open country in this district, and no settlers, although the soil is suitable for the production of cereals. The nearest post-office is Boutin in section 1, township 52, range 5. A branch line of the Canadian Northern railway from Shellbrook to Big River passes through townships 54 and 55, range 7. Once a week a passenger train leaves Prince Albert for Big River, returning the same day. Mixed and freight trains are running continually, but very irregularly. The Big River Lumber company is a gigantic enterprise, controlling most of the timber limits in this district. The capacity of the mills is 75,000,000 feet per annum When everything is in running order the estimated cut is

7,000 logs (about 400,000 feet) every twenty-four hours. They employ about 3,000 men in the mills and camps, and 300 teams. Big River village is situated on the south end of Cowan lake, has a population of 800, Catholic and Presbyterian churches, a general store and a school with a daily attendance of 60. The average wages paid for labour is from $26 to $40 per month with board and lodging. Cooks are paid from $75 to $90. Lumber, firewood and whitefish are shipped in immense quantities to Prince Albert and other points. Having completed the inspection of this contract on October 2, we proceeded to Prince Albert and after replenishing our supplies and having many repairs made to our outfit which had suffered to some extent on our long trip, we got our horses shod and left for contract No. 9, of 1911. This comprises townships 53, ranges 25, 26 and 27, parts of townships 54, ranges 25 and 26, west of the second meridian, and part of township 53, range 1, west of the third meridian. Following the Candle lake trail we crossed Garden river on a good bridge, and leaving this trail in township 52, range 24, reached the southeast corner of township 53, range 25 by one of our own trails where we commenced our inspection. There are no trails in this contract except those cut out by the contractor and the trail to Montreal lake, passing through township 53, range 1, west of the third meridian.

In general, the alluvial soil is black loam, varying in depth from two to six inches with sandy clay subsoil, suitable for the production of cereals and vegetables. The surface is level and low and covered with poplar four to twelve inches in diameter, interspersed with numerous extensive marshes and several large lakes of good water. A fair percentage of the timber is suitable for manufacturing purposes and railway ties, but recent fires have destroyed great quantities of timber in this district. There are but few hay meadows. Spruce river (Little Red river) and Garden river are the principal streams in this contract, the former being used by the lumbermen for conveying sawlogs to Saskatchewan river. Game, comprising moose, elk and jumping deer is very plentiful and we noticed a fresh beaver dam on Garden river. There are no settlers in this portion of the country, which in its present condition is not desirable for immediate settlement. The nearest place of business is Prince Albert about thirty-five miles distant.

From here we proceeded via Shellbrook, passing through a fairly well-settled district, to contract No. 11 of 1911, comprising, in part, townships 51, 52 and 53, range 9, west of the third meridian, where we arrived on November 3. We entered this contract from the east by a trail which connects with the Green Lake trail half a mile north of Boutin post-office and commenced inspection on November 4. The surface of these townships is rolling and hilly and is covered with poplar, birch and willow, of small dimensions, the poplar occasionally reaching a diameter of twelve inches. In the northern townships, however, the timber which is poplar, spruce and jackpine, with small birch and willow, is much larger and there is a quantity of spruce suitable for manufacturing purposes. There are a number of muskegs, a few creeks and an occasional hay slough. Big river meanders through townships 52 and 53, range 9, averaging sixty links wide, two to ten feet deep, with a current from two to four miles an hour. This river runs through a valley about two hundred feet deep, half a mile wide, and in several places wooded to the water's edge.

The soil throughout is a sandy loam with sand or gravel subsoil, and owing to the hilly surface, these townships are not well adapted for agricultural purposes, being better suited for ranching.

In townships 51 and 52, there are no trails other than those cut by the contractor. Boutin, on the Green Lake trail, is the nearest post-office, but Marcelin, between forty and fifty miles distant, is the nearest place of business.

We next inspected contract No. 12 of 1911, comprising townships 49 and 50, range 9, and townships 50, 51 and 52, range 10, west of the third meridian.

We entered this contract on a surveyor's rough trail and commenced the inspection on November 11.

The surface of these townships is level to rolling and is timbered for the most part with small poplar, birch and willow, although there are some scattered clumps of poplar and spruce of larger dimensions suitable for building purposes, particularly in township 52, range 10. There is a regular entanglement of small lakes throughout this contract.

The numerous hay marshes make this section of the country admirably adapted to ranching, and there are already several ranchers in this vicinity who appear to be doing well. The large amount of dead timber standing in several of the lakes show that in late years the water in these lakes has risen considerably. The greater portion of these townships is covered with small timber which can be easily cleared, and the soil which is black loam up to six inches in depth with sandy subsoil (although in places sandy loam is found with subsoil of sandy clay or gravel) makes a large tract of this land suitable for agricultural purposes. Fire-wood is abundant all through this section of the country. There is very little open country which is not muskeg or swamp, and except for the ranchers mentioned there are no settlers. North Battleford is the nearest place of any size where business is transacted, and Boutin the nearest post-office.

In addition to several branch trails to the different ranches there is a trail from Boutin post-office running through townships 50, ranges 9 and 10, and connecting with the trail from Witchekan lake to Marcelin, in township 49, range 11.

After the completion of this contract we moved into township 50, range 11, a portion of contract No. 13 not previously inspected. This township is for the greater part heavily timbered with poplar, willow and scattered clumps of spruce, and there are no settlers. There is a fine creek running through this township, and one or two inferior trails. We traversed a portion of Witchekan lake while at work here and then moved camp across Witchekan lake on the ice to township 53, range 9, in which we did some further inspection. The snow by now had become so deep that travelling on wheels was next to impossible, so I decided to stop work for the season and move into Shellbrook where I had made arrangements for the wintering of the outfit.

Marked advancement in settlement was apparent this season in every direction. Districts that a few years ago were uninhabited, are now well settled. Railways are being built all through the country, and towns are springing up in every direction. Settlement and progress are very much in evidence, and the settlers seem prosperous and contented.

The townships surveyed this year will open for entry thousands of homesteads, and although the new country opened is for the greater part bush, there are many sections ready for cultivation.

During the season we had several days of excessive heat, on May 5, the thermometer registering 100 degrees in the shade, and on the 10th of the same month a severe snowstorm lasted twenty-four hours. On October 30, we were able to cross several lakes on the ice and November was also very cold, the mercury sinking to 36 degrees below zero on the 25th.

On June 2 wheat was up five inches. The greatest amount of rain fell during the month of July. On September 4 a heavy frost did great damage to crops in Saskatchewan, and on November 6 the snow was six inches deep and by the end of the month it was over two feet.

We did not perceive any indications of minerals or coal during the survey. Great quantities of game, both of the feathered variety and of deer, abound throughout this country, moose and elk being very numerous north of Saskatchewan river.

APPENDIX No. 28.

ABSTRACT OF THE REPORT OF A. LIGHTHALL, D.L.S.

SURVEYS IN THE NEW WESTMINSTER DISTRICT IN THE RAILWAY BELT OF BRITISH COLUMBIA.

I arrived at Vancouver from Ottawa on April 18, 1911, and having purchased my supplies and organized my party I moved up the north arm of Burrard inlet to Bedwell bay. The work here consisted of the taking of some levels in the townsite of Woodhaven which had been laid out by Mr. A. W. Johnson, D.L.S.

Woodhaven is beautifully situated. It is only a few miles from Vancouver, faces the salt water and has a plenteous supply of fresh water procured from a small lake about a mile inland. The surface is rolling and any land not required for townsite purposes would make excellent farm land.

Having finished the work there on May 10, I proceeded to Pitt lake to survey several timber berths and to mark out as much of the limit of the railway belt as could be conveniently reached from the lake. The land there is very mountainous and surveying was slow, considerable time being spent in travelling to and from camp. The work might be more expeditiously carried on if a larger party were employed and two or three men kept packing provisions continuously, as much time is always lost when the regular party are moving camp.

The land will never be good for anything but timber as it is sometimes hard to find a place level enough to pitch a tent. Game is fairly plentiful, consisting of goats, bears, deer and grouse. Considerable water-power could be developed on Rainbow creek, which has a drop of about eight hundred feet in a quarter of a mile, and at low water has a flow of approximately five thousand cubic feet per minute.

Our next work was along Silver creek which flows into Pitt river from the west side just at the foot of the lake. Along this creek a tract of low, wet land extends for about two miles from its mouth. It is about a mile wide and has been formed by a deposit from the surrounding hills. This land is covered at high water, rendering it unfit for agriculture at present; but by dyking, it could be made into a good agricultural district well suited for grain growing or dairying. The higher ground at the foot of the hill is heavily timbered but would make good fruit-farming land as the soil is very fertile. It is easy of access as New Westminster can be reached by boat. The rock formation is granite with evidences of iron and copper but no minerals have yet been found in commercial quantities.

After doing some subdivision work in township 4, range 5, west of the seventh meridian, we surveyed a timber berth on Harrison lake, about eighteen miles from the foot of the lake. Harrison river at that season was very shallow and swift, but in high water it is sufficiently deep for large steamers to run to the lake. The mountains, though as high as around Pitt lake being about five thousand feet above sea-level, are not so steep and rugged, but the timber is smaller. As there is little agricultural land around Harrison lake the logging industry is likely to be the only one which will flourish. A summer resort has been opened up at the hot springs at the foot of the lake, and the district attracts sportsmen as bears and deer are numerous.

Stave river, a part of which I traversed next, is a rapid stream and navigable only for about two miles from its mouth. The surrounding country seems to be well adapted to fruit-growing as it is rolling, very fertile and well drained. The Western Electric company have developed a fine water-power on this river and have transmission lines to Vancouver and the surrounding district.

Having finished the traverse of Stave river on November 16, I paid off the party, stored the outfit and returned to Vancouver.



Freighting on the trail from Prairie Creek to Jasper Park

Photo by G. H. Hewett, D.L.S.

APPENDIX No. 29.

ABSTRACT OF THE REPORT OF G. J. LONERGAN, D.L.S.

INSPECTION OF CONTRACTS IN NORTHERN ALBERTA.

I reached Edmonton during the first week of April, 1911, and outfitting at once, started on the inspection of townships 62 to 66, inclusive, ranges 1, 2 and 3, west of the fifth meridian. There is a good trail from Edmonton to Belvedere and from this place there is but one road which gradually gets worse until you reach township 64, range 2, where it ends. In the above-mentioned townships there is some very good land in places. The northern part is chiefly sand ridges covered with jackpine and tamarack swamps, but the southern part is a clay loam mostly covered with heavy windfall. At one time this southern part was a spruce forest, but fire killed the timber and the wind blew the trees down making it almost impossible to get through. However it is only a matter of time till a second fire will burn up the windfall leaving the land ready for plowing.

My next work was a restoration survey of the northerly third of township 50, range 27, west of the fourth meridian. Most of this township is settled upon and as it is only about thirty-five miles from Edmonton with a fairly good road following the north bank of Saskatchewan river, it is easily seen that what land is left is practically useless for farming, although under the provisions of the provincial Drainage Act there are some very large marshes that can without much difficulty be drained and then the remaining quarter sections will make good farms.

While at this work I received your instructions to proceed to the Peace River district to examine the contracts there. It was now the end of June and as we had had a month of continual rain I knew that the trail would be practically impassable, I therefore arranged transportation for the party and outfit from Athabaska Landing to Grouard by steamer. During the winter travel over this trail is easy, there being no hardships for either men or horses. About every eight or ten miles along the road there are stopping-places, hay and stable accommodation and a bunk-house where the teamsters cook their meals and sleep, the charges being very reasonable.

Grouard, situated at the west end of Lesser Slave lake, is a settlement of about five or six hundred people. The Hudson's Bay company and Revillon Bros. have each a large store. There are also a couple of other merchants, two blacksmith shops, one drug store, two doctors, a telegraph office and a land office. The Roman Catholic mission have a large Indian school with two hundred children in attendance. The town being at the end of navigation and surrounded by a good farming country, is bound to be in the near future a place of some importance. The trail from Grouard to Peace River Crossing, a distance of about eighty miles, passes for the first forty miles through a thick poplar bush with scattered spruce both of which are large enough for lumbering purposes. The north half of the trail runs through more open country with large patches of prairie, and the soil changes from a clay to a sandy loam. Very little of this land is taken up. There are a few settlers with about three hundred acres broken, ready to crop in the spring of 1912.

Peace River Crossing is in a valley about six hundred and fifty feet deep. There are about a dozen houses, two stores, a post-office and a telegraph office. A cable ferry for teams, propelled by the current, crosses the river. There are two steamboats running between Fort Vermillion, one hundred and fifty miles down stream, and Hudson Hope, one hundred and fifty miles up stream. On the west side of the

river and about fifteen miles up stream in the valley are situated the Roman Catholic and Church of England missions and schools. They have beautiful farms producing and ripening all kinds of common vegetables and grains, also a flour mill where they do public grinding. Mr. Brick, a farmer located between the two missions, told me that he had successfully grown wheat for the past twenty-six years and it was never affected by frost.

Rising from the valley is a plateau about seventy miles by thirty miles in area, three-quarters of which is open country while the remainder is bluffs of poplar and willow scrub with a few scattered spruce. The soil varies from a clay to a sandy loam and in some places a heavy black loam. Settlers are scattered all along the trail from Peace River Crossing to Dunvegan, but there is room for thousands of others. I would not consider it advisable to start cattle ranching as the soil is too fertile and it will be but a few years till the country will be fenced up by farmers, and pasture lands will be as scarce as in the southern parts of the province.

At Dunvegan there is another cable ferry crossing Peace river, and south of the river valley begins the Spirit river district. The soil here is equal to the best I ever saw in Manitoba or Saskatchewan, about eighty per cent prairie, and farming is but in its infancy. I saw some unthreshed oats that would easily weigh forty pounds to the measured bushel. There is one store and a church in this settlement, and although the settlers are few, all whom I met were well satisfied that they had settled where they are. About fifteen miles south of the river is the north side of the Saddle hills, and for the next twenty miles the trail passes through thick poplar six to eight inches in diameter, with scattered patches of spruce ten to twenty inches in diameter. The hills in themselves are but slight elevations with no rocks. About the centre of township 74 is the north side of Grande Prairie. It extends from Smoky river on the east to Beaverlodge river on the west, and is bounded on the south by Wapiti river. It is about seventy-five miles long by thirty wide. In the west end there is less scrub and I would consider the soil better for farming, there being more black and sandy loam, while in the east the soil is chiefly a clay loam.

Grande Prairie settlement is situated in township 71, range 6, west of the sixth meridian. It has one large frame store, a school, a blacksmith shop, a land office, and a Roman Catholic church, with a dozen other houses. Its rival town, Beaverlodge, twelve miles west on Saskatoon lake, has Revillon's and Hudson Bay company's stores, a branch of the Canadian Bank of Commerce, a post office and a Church of England mission school. They also expect to have a telegraph office soon as the wires were up as far as Dunvegan last November. The settlers around Grande Prairie, like those along Spirit river, and between Peace River Crossing and Dunvegan, are scattered from one end of the district to the other making it quite clear that the soil is good all over, while each settler thinks he has the best location.

My next work was at Pouce Coupé prairie in the Peace River block. Leaving Saskatoon lake I went due west to Beaverlodge river, thence up that river to Sinclair lake, and from there a wagon trail was tracked through the scrub to Swan lake and down the south bank of Pouce Coupé river. This trail was but recently made and as there are no bridges across the many creeks, travelling was very slow. I can speak only of the southeast corner of the block. The surface of this part is rolling, the soil is a clay loam and about ninety per cent of it is prairie. From what I saw of it I would advise people who want to go in for cattle or horse ranching to settle here. Hay can be cut in abundance and there is ample supply of water in the creeks. Regarding frost the country is higher than the places previously mentioned but it being situated on the east end of the Pine pass it is reported that the warm winds from the coast protect it. There is but one settler in the district and he told me that spring was much earlier here than at Grande Prairie, with less snow during the winter.

Having completed the inspection of the contract I returned to Grouard and again loading up with supplies I started to inspect a contract west of Big Prairie settlement going as far west as Little Smoky river. From range 19 west of the fifth meri-

dian eastward the country traversed is covered chiefly with poplar six to eight inches in diameter and scattered spruce, with occasional patches of willow scrub and a small amount of prairie. From Winagami lake west to Smoky river is a large tract of good farm land without a settler. I was informed by an old hunter that the good land extended north almost to Peace River Crossing. The soil is a sandy loam and the country is almost level with about fifty per cent willow scrub, the rest being open prairie. The pea-vine climbs up the willow scrub making a net-work very difficult to get through. The grass in this whole district cannot be surpassed by any in the western provinces. There will be no difficulty in obtaining water, as wells could be sunk anywhere and water obtained in less than twenty-five feet.

On November 16 the work for the season being completed, we broke camp and started for Edmonton going via Grouard and Sawridge.

APPENDIX No. 30.

ABSTRACT OF THE REPORT OF E. S. MARTINDALE, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHWESTERN ALBERTA.

Having completed the organization of the party at Medicine Hat we proceeded to our first work in township 7, range 3, west of the fourth meridian.

This township lies immediately south of the forest reserve at the western end of the Cypress hills, and is broken by the valley of Lodge creek. This valley is about a mile wide and has banks varying from 300 to 400 feet in height. To the east of the coulee the land lies in a fairly level bench broken by ravines, which, in the northern portion of the township, are wooded with small spruce, and poplar and willow scrub; to the west, the country is rough and hilly. Most of the northern and eastern portion, the soil of which is loam, is taken up and is being rapidly fenced. The settlers are mostly English and German, and are following the methods of mixed farming.

The great drawback to this district is the uncertainty of obtaining sufficient moisture to grow and mature the crops. A few attemps are being made to irrigate in the Lodge coulee, but the supply of water available is not sufficient to allow of any extensive operations.

Retracement work was continued in township 7, ranges 4 and 5. Township 7, range 4, is rough and hilly and is used almost altogether for ranching purposes. Township 7, range 5 is not so hilly and the western part is being taken up by settlers.

Wood for fuel can be obtained in the northern part of township 7, range 3, and lignite is found in some of the ravines of the same township. Many of the settlers obtain their fuel from a small coal mine which is being operated near Eagle Butte post-office in township 6, range 4.

In the latter part of June I was informed by parties living in the foot-hills, that conditions in the mountains were favourable for surveying. Accordingly the retracement work was brought to a close and the outfit was shipped from Seven Persons on the Crowsnest line of the Canadian Pacific railway to the town of High River. I proceeded to Calgary to purchase ponies and a pack outfit for use in the mountains.

Leaving High River on July 4, we reached township 17, range 4, west of the fifth meridian, the following day. A good wagon road runs westward from High River to the foot-hills and follows the north bank of Highwood river into the mountains. The country which a few years ago was used exclusively for ranching is now settled and fenced, and is devoted to the growing of grain. The rancher has been driven back into the foot-hills where he is protected from the further encroachments of the homesteader by summer frosts.

On July 6 the subdivision of township 17, range 4, was commenced, and, completing this a week later, the survey of township outlines was begun. This work was in typical foot-hill country, consisting of a succession of high ridges, more or less sparsely wooded with scrubby jackpine and poplar. Trap creek, a small swift mountain stream was crossed in section 25. The north boundaries of townships 17, ranges 5 and 6, were next surveyed. The main ridge of the Highwood range was crossed in section 35, township 17, range 6; it runs in a northwesterly direction at an altitude of from 8,500 to 9,500 feet. While in the Trap creek valley and before crossing the mountains, the block composed of sections 34 and 27, township 17, range 5, was outlined. The country along the eastern portion of the north boundary of range 5 is similar to that along the east boundary except that the ridges are higher and more rocky and are in some cases covered with small jackpine. Trap creek was again crossed in section 33. The first genuine mountain work was experienced here and extended partially across range 6.

An outcrop of soft coal, bright and clean, and apparently of good quality was noticed in the bank of Trap creek at the point where it is crossed by the east boundary of section 34, range 5. There is no timber worth mentioning in the Trap creek valley, except a small area at the head of the creek in section 36, range 6. However, the difficulties to be overcome in getting it to market are too great to make it of any commercial value.

In crossing the Highwood range it was necessary to move the outfit down Trap creek to Highwood river, then along the lumber company's road to their camp in section 21, township 17, range 6.

Highwood river is crossed by the north boundary of range 6 at the northeast corner of section 31. It is a swift mountain stream about forty feet wide and one and one-half feet deep. The country between the Highwood range and the river is similar to the foot-hills in appearance and consists of high sandstone ridges, which, generally speaking, run parallel to the river. It had been well timbered along the outline, but was overrun by the fierce forest fire of 1910. Practically all of the timber in townships 17 and 18, range 6, which was spruce and jackpine up to thirty inches in diameter, was included in timber berths Nos. 1429 and 579, while that in range 7 lies in timber berth No. 292. A portion of that in timber berth No. 292 lying near the British Columbia boundary escaped the fire. The Lineham Lumber company operating on timber berth No. 579, had one large camp working on the burnt timber last winter (1910-1911), and are also working on it again this winter.

The subdivision in townships 18, ranges 6 and 7, was completed on October 16, and we next proceeded with the subdivision in township 17, range 6, completing it by the middle of November.

The coal in the Highwood valley is found in the high sandstone ridges before mentioned. According to analyses which have been made, it is practically an anthracite. This field when opened up should yield a large supply of first-class household fuel. The district is readily reached and a railway into it could be built without meeting any serious constructional difficulties by following Highwood river into the mountains.

Several deer were seen, also some blue grouse, spruce partridge and ptarmigan.

The work of the Highwood valley being completed, we moved to township 19, range 7, by following up Sheep river. The subdivision was completed by December 1, and we arrived in High River on the 3rd.

After paying off the party and making arrangements for the wintering of the outfit, I commenced the small miscellaneous surveys in northern Saskatchewan, for which I had received instructions. On this work I was accompanied by one assistant. We first investigated the marking of a witness post on the north boundary of township 36, range 12, west of the third meridian. The land here is mostly settled and is used for grain growing.

We next traversed the south bank of South Saskatchewan river across township 48, range 24, west of the second meridian, and, after investigating the old traverse of the north bank, traversed that also. The country is partially wooded with small poplar and there has as yet not been very much settlement. A ferry is maintained at the point where the surveyed trail from Prince Albert crosses the river in this township.

The marking of a witness post near the southeastern end of Fish lake in township 52, range 1, west of the third meridian, was next investigated and the necessary corrections made. No settlement has yet been made in this township. The country is gently rolling, more or less thickly crown up with small brush and is also partially wooded with poplar. The timber has practically all been taken out from around the southeast end of the lake.

A resurvey of the south boundary of section 1, township 23, range 33, west of the principal meridian, was next made. This district is settled and some of the farmers have fine houses and barns. While engaged on this work the weather was very cold and severe and as meanding could not be done without serious inconvenience we closed operations for the season and arrived home on January 14, 1912

APPENDIX No. 31

ABSTRACT OF THE REPORT OF H. MATHESON, D.L.S.

RESURVEYS IN SOUTHWESTERN ALBERTA.

On December 3, 1911, I took over the party and outfit of Mr. G. H. Herriot, D.L.S., and began correction surveys in townships 52 and 53, ranges 21, 22 and 23, and township 52, range 24, west of the fifth meridian.

Athabaska river, which I traversed through these townships, runs northeasterly through townships 52, ranges 23 and 24, and townships 53, ranges 22 and 23. Its banks are from two to three hundred feet high. McLeod river, which has banks from forty to sixty feet high, and which I also traversed, runs easterly and northeasterly through townships 52, ranges 21 and 22 respectively.

The Grand Trunk Pacific railway runs between the McLeod and Athabaska rivers and the Canadian Northern railway company are building a parallel line a short distance to the north. Much of the grading is already done but no steel is yet laid. Most of the country was at one time fairly well timbered with spruce, pine, tamarack, poplar, and a little white birch, but owing to frequent forest fires a large part of this district is now covered with brulé and small pine. Merchantable timber still grows on the banks of the Athabaska in townships 52, ranges 23 and 24, along the Grand Trunk Pacific railway in ranges 22 and 23, and in the valley of McLeod river. Patches of good timber are also found in other parts.

The soil varies from almost pure sand to sandy loam and in places boulders are found. The surface of townships 52 and 53, ranges 21 and 22, is mostly flat and much of this area is covered with shallow muskegs which could be easily drained and which are wooded with small spruce and tamarack. Between the muskegs are sandy ridges covered with jackpine. No attempts have been made at cultivation but scattered bunches of good timothy near the railroad give evidence of the fertility of the soil.

The principal industry is making railroad ties where suitable timber can be found convenient to the railroad, and two sawmills are now in course of erection.

Many trails are found between the Athabaska and McLeod rivers, along which packhorses can travel, and roads were cut along the railway at the time of construction, so that travelling through this district is an easy matter.



Fiddle Creek Canyon—Jasper Forest Park Reserve

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APPENDIX No. 32.

ABSTRACT OF THE REPORT OF C. F. MILES, D. L. S.

INSPECTION OF SURVEY CONTRACTS AND MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN.

Our survey operations for the season were commenced on May 6 at Many Island lake. The work there consisted of building monuments left unfinished last season when the dry bed of the lake was subdivided. Owing to the large amount of rainfall causing a greater area of the lake bed to be covered by water the expectations of the settlers with regard to the quantity of hay to be secured will scarcely be realized this year but under ordinary conditions I believe large quantities of hay may be obtained there. From there we moved to Bigstick lake where our work consisted of restoring some obliterated monuments in township 14, range 26, west of the third meridian. The trail we followed to this place passed through a grazing country and large flocks of sheep as well as horses and cattle were observed. No dwellings were seen although some of the land had been recently broken by homesteaders.

After completing this work and some retracement in township 46, range 27, west of the second meridian, I left for Edmonton and from there, on July 3, proceeded to the inspection of contract No. 22 of 1910, which consisted of townships 61, 62, 63, 64 and 65, range 18, west of the fourth meridian. On our way to this contract we passed through Pakan, a small settlement in township 58, range 17, west of the fourth meridian. This was formerly an old Hudson's Bay post and went by the name of Victoria. It has stores, a hospital, post-office flour-mill and blacksmith shop. A ferry crosses Saskatchewan river at this point and a mail coach runs to Lamont, a station on the Canadian Northern railway. From Pakan we proceeded north through Galician and Russian settlements. There we saw good crops and well fenced farms, and their thatched houses washed with white clay on the outside give the impression of thirft and industry. A portable sawmill was in operation at White-earth river.

The surface of the townships in contract No. 22 is rolling and interspersed with marshes and hay meadows. The soil consists of a layer of black loam of variable depth over a subsoil of sandy loam. The timber is mostly poplar and spruce with some tamarack in the muskegs.

After completing the inspection of contract No. 22 I made a partial inspection of contract No. 20 of 1910, which lies southwest of lac la Biche, and then proceeded to contract No. 26 of 1900, passing through Lac-la-Biche settlement. We reached township 63, range 10, west of the fourth meridian which is in the westerly portion of this contract and continued the inspection easterly. We then moved easterly along Beaver river to township 61, range 3, where we made some resurveys. While on our way to the latter township I went to St. Paul-de-Metis for supplies. This is the largest place north of the railway. It has several general stores, two hotels, two blacksmith shops and a number of other industries. A daily mail stage runs to Vegreville, which lies about sixty-five miles to the southwest on the Canadian Pacific railway.

Our next work was the subdivision of a portion of the west part of Cold Lake Indian reserve. West of the reserve the country is nearly all solid woods except where it is interspersed with sloughs or hay marshes. The reserve is mostly open prairie. Along the trails in the reserve, fields of grain, mostly oats, were seen, also some patches of wheat. Most of the wheat as well as some of the oats was injured by frost. Potatoes, however, appeared to be a successful crop.

After resurveying a portion of township 62, range 2, we returned to contract No. 26, of 1909, which lies west of Cold lake and completed the inspection of the eastern half. This part of the contract is all wooded and the soil is generally light. Cold lake is a large body of water, said to be sixty fathoms deep and teeming with whitefish and salmon trout. Fishing on an extensive scale is carried on here in winter, the fish being taken on sleighs to the Canadian Northern railway, nearly one hundred miles distant.

I next inspected contract No. 14 of 1910, which lies northwest of Cold lake. The country in this contract is similar to that in contract No. 26 of 1909, except that the muskegs are more numerous and of greater extent. There are also a number of lakes, one of which in townships 65, ranges 2 and 3, covers approximately eight thousand acres.

We completed this inspection on November 7 and returned to Cold Lake settlement and thence to contract No. 18 of 1911, which lies southeast of Cold lake. The trail we followed passed through undulating country wooded with poplar and spruce. East of the fourth meridian the country passed was level and more open with a sparse growth of jackpine and scrub poplar. North and south of the trail the country is more heavily wooded. South of Mudie lake is all fairly level, being mostly hay meadows.

The inspection of contract No. 18 being finished we moved to contract No. 17 of 1911, and completed this work on December 7. We then proceeded to township 54, range 22, west of the third meridian, to perform some resurvey, following a good trail through partly open country wooded in places with poplar and jackpine. About nine miles from St. Walburg we saw the first settler and farther south found practically open prairie well settled.

As our next work was retracement in township 67, range 12, west of the fourth meridian, we left for Lac-la-Biche settlement via St. Paul-de-Metis. The journey, which occupied five days, was through fairly open country with plenty of hay except at the crossing of Beaver river.

Having finished this work and also some retracement along the correction line west of Egg lake, I proceeded with the inspection of contract No. 20 of 1910. The townships in this contract are very level with poplar woods predominating. It would seem that this section was best suited for mixed farming and cattle raising.

On January 26, 1912, we closed operations for the season and started for Athabaska Landing.

APPENDIX No. 33.

ABSTRACT OF THE REPORT OF A. L. MACLENNAN, D.L.S.

SUBDIVISION AND MISCELLANEOUS SURVEYS AT LE PAS

The village of Le Pas, situated on the south side of Saskatchewan river, has a population of about 400. There are in the place several stores, a dentist, a newspaper office, schools, churches and two hotels. The Finger Lumber company has just completed the first section of a large sawmill. When completed they expect it to have a daily capacity of about 40,000 feet of lumber and to employ about 5,000 men. The spruce logs for the mill are obtained from extensive timber limits some 60 miles up Carrot river, a stream which flows into Saskatchewan river about two miles from Le Pas.

On the north side of the river and opposite the village is an Indian settlement with a population of about 450.

Our work consisted of the survey of a booming site on Carrot river for the Finger Lumber company, and subdivision surveys in township 56, range 25, and townships 56 and 57, range 26, west of the principal meridian. There are in these townships numerous lakes and sloughs, some of which, however, are very shallow. Reader lake in township 57, range 26, being only about three feet deep.

The soil is very light and in many places is merely light gravel covered by thick moss. Spruce timber grows very thickly but it is rather stunted. The surface is slightly rolling but is not hilly with the exception of a high ridge on the north bank of Saskatchewan river.

On account of the sandy nature of the soil vegetables and particularly potatoes, will likely be grown by the homesteaders settling in the vicinity of Le Pas. The extensive hay meadows which border the sloughs will enable cattle-raising to be carried on but cereals cannot be successfully grown unless some means of draining the extensive swamps can be found

Whitefish, pike, pickerel and sturgeon are plentiful in Saskatchewan river and ducks are also numerous, while fur-bearing animals consisting of bears, foxes, mink and muskrats are found in considerable numbers.

APPENDIX No. 34.

ABSTRACT OF THE REPORT OF J. B. McFARLANE, D.L.S.

SURVEY OF PARTS OF THE FOURTH MERIDIAN AND THE TWENTY-FOURTH BASE LINE WEST OF THE FOURTH MERIDIAN.

I reached the northeast corner of section 13, township 95, range 1, west of the fourth meridian, where my work was to begin, on June 15. Work was continued on the meridian until September 27, the line being then completed to the north boundary of township 105. A pack-trail was cut this far north and a sleigh trail as far north as section 12, township 102. Here a cache was built for supplies near a small lake around which there was some good hay, and about two tons of this was cut. The intention was to freight supplies this far north, as soon as snow came, for the production of the line. This plan was frustrated by the fact that oats were not sent down the Athabaska as ordered. However, the line has been run through the most thickly timbered country and freighting can be done much easier from the north. Hay was also put up at all points along the line where any could be found. About twenty-two tons in all were put up and the greatest distance between places where hay was secured was from Clearwater river to the north boundary of township 95

As the distance from the Clearwater to township 105 was too far to pack, being at least 120 miles by trail, the outfit was moved south on September 28 and reached the 24th base line on October 8. Here supplies had still to be packed from the Cascades on the Clearwater although the horses had been eating frozen grass for a month and a half, and hay was too far away to be used. By November 7 there was about five inches of snow on the ground and a load of supplies was taken from the Clearwater on sleighs, reaching the camp on the base line on the 13th. The sleighing was so poor that only supplies for the immediate use of the party could be hauled. On November 27 the 24th base line was completed across ranges 1 to 4, west of the fourth meridian, and a sleigh trail was cut from the meridian to section 35, township 92, range 4.

On November 28 we started for Prince Albert via the old Hudson's Bay company's winter trail from Clearwater via Methye portage, Methye lake, Buffalo lake, Ile a la Crosse, then by a new trail overland, crossing Beaver river at La Plonge, thence to Doré lake, Sled lake and DeLaronde lake. The ice was good on all the lakes and rivers but the northern part of the new trail was scarcely broken and consequently rough. On reaching the Hudson Bay company's post on Methye lake we got the oats left there by Mr. Wallace the fall before and as our horses had been on short rations they made the rest of the journey very well.

We reached Big River on December 19, and after waiting two days for a train we reached Prince Albert, where the party was paid off on December 22

DESCRIPTION OF THE COUNTRY ALONG THE FOURTH MERIDIAN.

The land along the fourth meridian from township 95 to township 99, inclusive, is close to a watershed and is composed of rolling sand hills. A number of creeks, all taking their rise within a few miles east of the meridian, flow westerly or northwesterly across the line. The creeks in general take their rise in muskegs. The small creeks generally have muskeg along their courses and often lose their channels crossing muskegs and form again where they have more fall. Creeks of medium size are in general dammed by beaver and consequently have a growth of willow and grass along their banks. This grass in the beaver ponds and old beaver meadows is the only hay in this district and is almost the only grass in all the country I worked in this season

The larger streams, such as Firebag river, which crosses the northeast corner of section 25, township 96, have apparently enough water for the beaver without dams. Along these streams the entire river flats consist of wet muskeg from the water's edge to the rising ground forming the banks of the valleys. The water in all the streams is fresh and fish are plentiful in all the creeks and lakes.

The northeast corner of section 36, township 100, is crossed by Richardson river which is the largest stream the line crossed this season. This stream, at the meridian, is about 300 feet wide, three feet deep and has a current of about two miles per hour. It is called Jackfish river by the Indians and empties into a small lake at the southwest end of Athabaska lake. The valley of this river is deep, being about 550 feet lower than the hills in the southern part of township 100, and it is about a mile wide except where joined by creek valleys. Its sides are rough, broken hills. The river flows northwest and a rough range of hills crosses the line in township 101, running from the river northeasterly. The north side of these hills is rough, and broken with deep ravines. From here the altitude drops rapidly to the north as far as the meridian was run, indicating that the slope from here is towards Athabaska lake. Throughout township 102 the country is much the same formation, rough sand hills averaging about 200 feet above the valleys and ravines. On many of the hilltops throughout this country from township 95 to township 102 the sand is fine enough to blow but there is too much gravel and stones mixed with it to have shifting sand hills even where the timber is thin enough for the wind to strike the hills

North of township 102 the country is different, townships 103, 104 and 105 are much nearer level and 103 and 104 especially are very stony and dotted with small lakes. On some of the small ridges in these townships no soil can be seen among the stones forming the ridges. South of township 104 very little limestone was seen but from the southern part of this township north, about one-third of the loose rock is limestone. No solid rock projections were seen but boulders up to to ten feet in diameter were met with. In township 103, Old Fort river takes its rise a few miles east of the meridian and crosses the line on section 13. It flows through many small lakes, generally with several rapids between, and at some of these considerable power might be developed. Another small river takes its rise in the southern part of township 104, and flows northerly from a small lake on sections 12 and 13. This stream crosses the line on the east boundaries of sections 13 and 36, in township 105, and continues in a northerly direction. There are some rapids on this but I think none so valuable as on Old Fort river.

This stretch of country from township 95 to township 105 has very little protection from fire. The land is about nine-tenths sand with a growth of jackpine on it and the small muskegs, lakes or creeks wide enough to stop a fire are comparatively insignificant. There is therefore very little of this area that does not get burnt over on an average once in ten years, and consequently there is no timber of value. Nearly all trees six inches in diameter have been scorched several times. Their growth is stunted and they are dead on one side. There is a great deal of thick second-growth jackpine and in many paces thick windfall. There is no open country as about three years after a fire the young jackpine is up thick enough to kill what grass has started on the fresh brulé. The soil is destroyed as well as the timber and the usual covering on the sand is one to two inches of moss and needles. The only timber of value noticed was a few small patches of fourteen-inch spruce and ten-inch birch, poplar, balsam and jackpine on sections 1 and 2, township 101, on the slope of the north side of the valley of Richardson river. On account of the predominant sandy soil this country is not suitable for agriculture. The muskegs that can be drained might form good soil but these form a small proportion of the land. Summer frosts were prevalent and the season short. Rain was plentiful but generally in small or drizzly showers. There is enough fall to all creeks so that no land is flooded but the water in the muskegs rises or falls according to the amount of rain. The country is in general roughly rolling to hilly and the depth and width of the valleys, the sides of which

are generally steep, increase with the size of the streams in them. Wood fuel is everywhere plentiful, but no minerals were noticed. Game is fairly plentiful throughout this country, and fine specimens were seen of moose, caribou, bears, wolves, foxes, beaver, mink, marten and ermine. The three latter are very small for their species. Chickens and ducks are also numerous. All this country is an old Indian hunting-ground and the whole country is traversed by hunting-trails mostly running in an easterly direction and consequently of no use for survey trails.

TWENTY-FOURTH BASE LINE WEST OF THE FOURTH MERIDIAN.

Ranges 1 and 2 along the 24th base consist mostly of rolling sand hills covered with small jackpine. From the west side of range 2 the water flows north, while from the east side of range 1 the water flows southwest. The divide between the water flowing north and the water flowing into Clearwater river crosses township 93, range 1, and the northwest part of township 92, range 2, in a southwesterly direction, around a large muskeg basin emptying north including the most of township 92, range 3, and thence to the northwest over the large plateau called 'Muskeg mountains.' Townships 92 and 93, range 3, are taken up largely with a basin containing jackpine, spruce, tamarack and birch, which nowhere averages above six inches in diameter It has a gentle slope to the east and empties to the north. This basin looks like a wide depression through which a large creek would flow to the south into High Hill river. But the hills to the west are the highest in the locality and as the rise is gentle and unbroken the hills look much lower than they are. Range 4 is on the top of the 'Muskeg mountains.' The base line passes over the summit at the middle of the range reaching an altitude of 2,330 feet. The plateau consists of stony stretches of sand almost level, with patches of muskeg and the whole is covered with jackpine, spruce and tamarack averaging less than six inches in diameter.

APPENDIX No. 35.

ABSTRACT OF THE REPORT OF GEO. McMILLAN, D.L.S.

SURVEY OF THE TWENTY-FIRST BASE LINE ACROSS PEACE RIVER BLOCK.

The survey of the twenty-first base line was begun on March 31, 1911, at the northeast corner of township 80, range 13, west of the sixth meridian.

The monument marking this corner which was 16.70 chains too far south was moved into correct position and from this point the base line was produced westward.

Half a mile west of the starting point is Pouce Coupé river, a swift stream about 110 feet wide. It rises in Sucker lake and flows into Peace river about twelve miles north. The valley is two miles wide and about 550 feet deep at the base line, the depth increasing all the way to Peace river. Along the river high rocky banks and river flats alternate.

The soil in range 13 is principally clay, the vegetable loam having been burnt away, and nearly all the timber is fire-killed. This dead standing timber consists of jackpine, spruce and poplar varying in size from four to sixteen inches in diameter. There is hardly any fallen timber as the trees have not been dead long enough to fall. Range 13 is the roughest part of the base line, there being two deep valleys. The deeper one is made by Pouce Coupé river while the other one, three miles west, is almost as deep, although the stream in the latter is only a few feet wide.

The surface in range 14 is undulating with no ravines, and the soil and timber are more thoroughly burned than in range 13. The north limit of Pouce Coupé prairie is about three miles south of the base line and runs in a southwesterly direction, the timbered area widening to the south of the line as far west as the Kiskatinaw river in range 16. Peace river is about nine miles north of the line and the Kiskatinaw flows into it about the middle of the range. For the first two miles north there is a series of beaver meadows and for the remaining distance to Peace river there is heavy green spruce up to thirty inches in diameter.

The soil and surface of the east half of range 15 resembles that of range 14, and in section 33 commences a forest of spruce, jackpine, balsam and poplar extending with one interruption to Pine river. This forest comprises about two hundred square miles of timber up to forty inches in diameter and is accessible to Kiskatinaw and Pine rivers. The other streams between these two rivers are not large enough for rafting logs and it is probable that they dry up in summer. The soil in this forest is a sticky clay loam covered with a thick green living moss which holds the moisture and which must have protected the timber from destruction when fires destroyed so much surrounding it.

Kiskatinaw river is crossed by the base line in section 35, range 16. It has its source near that of Red Willow river and is very crooked and swift. It has a stony bottom and a valley about two miles wide and 550 feet deep. It cannot be forded in high water and on May 2 its waters were so charged with sediment that they resembled black ink and were totally unfit for drinking. In its banks are some thin seams of coal, lumps of which are constantly falling into the water. To the west of the river the line runs through about eight miles of large scrub, small poplar and some large green spruce, the heavy forest previously referred to being to the north. Near the east end of the north boundary of section 32, range 17, the base line crosses the pack-trail leading from Fort St. John to Pouce Coupé and Grande Prairie. This trail seems to be very old and is the leading thoroughfare for hunters and others going to and from Fort St. John. From Kiskatinaw river to Grande Prairie this trail has been widened and improved into the present wagon road.

The district from the Fort St. John pack-trail to Pine river comprises part of the green forest already referred to. It is from from four to nine miles wide and about twenty-four long including ranges 18, 19, 20 and four miles in range 21. To the north and south of this green timber the surface is rolling and covered with thek large scrub of willow and poplar and patches of second growth poplar, jackpine and spruce.

Pine river is intersected by the base line in section 32, range 21. It rises in the mountains and is the second largest stream in the Peace River block. It has a stony bottom, is from ten to twenty chains wide and twenty feet deep at high water, and has a valley two miles wide and seven hundred feet deep. There are some prairie flats along its course where much hay can be procured and back of these flats are high, bare hillsides producing pea-vine and other grasses excellent for pasturage.

From Pine river to Moberly river, a distance of about thirteen miles, the surface is rolling and scrubby with occasional patches of large spruce. There are some small swamps that can be easily drained and in some places hay can be procured. The soil is suitable for stock-raising and farming. Water is abundant and there is plenty of timber for fuel and other requirements.

Moberly river was crossed in section 32, range 23. Its banks are low, resembling those of eastern rivers, and the water is of a light brown colour. It has a swift current, is about 100 feet wide and two feet deep in the rapids and can be forded almost anywhere. It has its source in Moberly lake about twelve miles south of the base line and flows northeasterly into Peace river.

From Moberley river to the western extremity of the block the soil becomes more sandy and is timbered with spruce, poplar and jackpine of medium size except in the valley of Peace river where the trees reach thirty and forty inches in diameter. The soil in the Peace river valley is of the very best quality, there being in some places about two feet of vegetable loam. The pack-trail from Moberly lake to Hudson Hope is reached near the northwest corner of section 32, range 25. It is a very old and well-beaten trail and is in good condition.

The Peace river valley is entered about the middle of the north boundary of section 36, range 26, the last mile of the 21st base line being in the valley. The last post was planted at 38.40 chains west of the northeast corner of section 35 on August 12, and the same day a start was made on the west boundary of the block.

Adjoining the west boundary from the 21st base south there is no land suitable for settlement except a strip about one mile wide along Moberly river in section 27, township 78. This strip is good as far east as Moberly lake, a distance of about three miles. The surface of the remainder is hilly and the soil swampy or stony. In township 80 there are some spruce up to thirty inches in diameter but through townships 79, 78, 77 and 76, no valuable timber was met with. These townships are largely covered with willow scrub of large size and so thick that the tops and branches have grown together in such a manner that they have to be pulled to the ground after being chopped off. There is also considerable small poplar, jackpine and spruce which are of no value.

There is a small lake near the north boundary of township 79 and about two miles east. This lake is about one hundred chains long and forty chains wide and is surrounded by a floating muskeg.

Moberly lake, which is about fifteen miles long and four miles wide, is situated in townships 78, ranges 24 and 25, and is the most important lake in the Peace River block. It contains large numbers of whitefish, jackfish and trout while innumerable geese and ducks are found on its waters. On the west and north sides there are ridges about half a mile from the lake, the intervening space being a scrubby prairie. On this prairie are found wild fruits, such as cherries, strawberries, raspberries, saskatoon berries and blueberries. I saw there also potatoes, turnips and radishes which were equal in size to those grown in Ontario and which had been matured without injury from frost.

The southwest corner of the block is on a bare sidehill and is about 120 chains from the west branch of Pine river. The survey was completed on October 10 and the next day with the party I left for Edmonton.

The route followed was the Pine river pack-trail which leads to Ponce Coupé and traverses the prairie nearly all the way. For about twelve miles this trail follows Pine river valley then turning north follows the prairie above the valley uniting with the trail from Moberly lake to Pouce Coupé, about range 22. It is a good trail all the way and there are good fords across Pine and Kiskatinaw rivers.

That agriculture can be successfully carried on in the Peace River block seems very probable. The soil seems well adapted for raising crops, the climate alone being doubtful. Although crops of last season were frosted, the area under cultivation was very small and that is hardly a fair test for a large area. The rainfall was excessive and the crops, slow in maturing, were caught by the frosts. There is a prairie west of Kiskatinaw river which I think is as large as Pouce Coupé prairie. It comprises a valley beginning at the river and averaging from four to ten miles wide and with a few interruptions extends to the southwest corner of the block. The soil is good and is suitable for agriculture and stock-raising. There are blue-joint meadows, wheat grass and other wild grasses in abundance. The scrub lands, except in range 26, are also good but hard to clear.

The timber lands comprise the forest previously referred to and also some valuable timber in all the river-valleys. I think it hardly necessary to retain this forest as a timber reserve as there is plenty of timber scattered elsewhere to meet the requirements of settlers.

Pouce Coupé, Kiskatinaw, Pine and Moberly rivers contain a permanent supply of fresh water and water-powers can be developed on them all. The permanency of the supply of the smaller streams is doubtful, depending to a great extent upon whether the season is wet or dry.

Shale rock and thin seams of coal appear in the banks of all the rivers, but no other minerals were met with although there is said to be a limestone deposit on Pouce Coupé prairie.

The game consists of moose, deer, partridges and prairie-chickens, and the fur-bearing animals are the black bear, grizzly bear, lynx, otter, beaver, marten, mink, fox and weasel.

The spring season was cold and backward in the timber lands and the snow remained till May 1. On Pouce Coupé prairie there was considerable new grass as early as May 15, the first summer frost occured on July 19 and frequently after that date, while four inches of snow fell on September 12.

APPENDIX No. 36.

ABSTRACT OF THE REPORT OF A. L. McNAUGHTON, D.L.S.

MISCELLANEOUS SURVEYS IN WESTERN ALBERTA.

My survey operations for the season were commenced on July 21, 1911, the first work being in township 46, range 19, west of the fifth meridian. After carrying on subdivision here for about three weeks I moved to township 45, range 20, and surveyed the east outline. The route followed to this township was along the bed of Southesk river. This would have been impassable at high water as the stream had to be crossed and re-crossed several times.

Our next camp, on Pembina river, was reached by an old trail over the hills. A splendid view of the Rocky mountains may be obtained from this trail. On a clear morning the bare hilltops permit an unobstructed view of a hundred miles of snow-topped peaks glistening in the sun. From here we continued subdivision work in township 46, range 19, until October 5. During this period we had a three days' snowstorm which lasted from September 20 to 22. From that time on, however, the weather was fine.

On October 6 we moved camp to Coal creek and from this date until December 20 we were engaged in the subdivision of land contiguous to the Alberta Coal branch of the Grand Trunk Pacific railway. From there we moved camp over the frozen muskegs to the north boundary of township 46, range 19, and by December 30 had completed the subdivision of the northerly two-thirds of this township, with the exception of the correction line.

We then left for Edmonton, via Edson, arriving there on January 4, 1912.

Up to the present the district surveyed has been reached by pack-trail from Big Eddy, a place on the main line of the Grand Trunk Pacific railway. This trail, which is in poor condition, follows McLeod river southwest from Big Eddy to the mouth of Embarras river, thence up this river about five miles, where it divides, one branch following the west fork of the river to township 48, range 21, and the other following the east fork to township 47, range 19. Another trail running southeasterly from township 48, range 21, connects the termination of these two trails. About forty-five miles of wagon road was also built last spring along the branch line of the railroad, but it was almost impassable in the wet season. It is expected that the railway will be in operation next spring as far as township 49, range 21, and will be completed to township 47, range 19 during the summer.

The north part of township 46, range 19, is nearly level, consisting of muskeg and intervening ridges of jackpine. Toward the southwest the country becomes more hilly, rising into high ranges on the south and west boundaries. This is one of the few areas in the district which show no trace of having been swept by forest fires. Green spruce and jackpine predominate but are of no immediate commercial value. At the forks of the Pembina and westerly along the river are occasional meadows which afford good pasture during the summer months. An outcrop of coal was seen on the south bank of Pembina river, about half a mile west of the mouth of the Little Pembina. This land has been leased to the Pacific Pass Coal company.

The Alberta Coal branch through ranges 20 and 21 traverses a broken hilly country following a chain of valleys considerably lower than the surrounding hills. These hills occasionally rise five or six hundred feet above the valleys. The most prominent range parallels the railway on the north side and is a continuation of the watershed between the Embarras and Pembina rivers in township 47, range 19. Southwest of

the railway in townships 17 and 18, range 20, the surface rises through irregular hills to a nearly level plateau, which extends a few miles to the south. In range 21 this plateau is again lost in broken hills. The district throughout is covered with brulé and second-growth jackpine and is no doubt underlaid by the same seams of coal which outcrop in township 17, range 19, and township 19, range 21. Good pasture is found on some of the bare hillsides, two or three miles north of the railway and especially in the northwest part of township 18, range 20.

The east boundary of township 45, range 20, traverses a broken hilly country. Beginning at the twelfth base line, which is at this point about three-quarters of a mile north of Brazeau river, a gradual ascent of half a mile leads to the top of the range dividing the Brazeau and Southesk rivers, and a broken descent of two miles to Southesk river follows. This river apparently has a glacial source, as its water has the characteristic blue colour of such streams and is very cold. The river flows between high cut banks and the current is very swift. Continuing, a broken ascent of two miles along the line leads to the watershed between the Southesk and Pembina rivers. There is a very noticeable difference between the waters flowing into these two rivers. The Southesk waters are very clear, while streams flowing towards the Pembina are discoloured by vegetable matter. This difference is probably due to a greater rainfall in the Pembina valley and consequently a more luxuriant growth of mosses. North of the divide there is a broken descent of two and one-half miles to Pembina river. The south four miles of the east outline of township 45, range 20, passes through a burnt country covered with brulé and small jackpine. North of this the outline passes through green spruce and jackpine, also of small size.

The soil throughout the district surveyed is for the most part a sandy clay or loam and is saturated with water, especially in the green bush and on the northern slopes of the higher hills. I have seen a packhorse mired on a fresh trail along a hill-top. This indicates the presence of a soil almost similar to quicksand. However, this is exceptional as there is generally firm footing, except in muskegs.

During the summer months rain-storms, and especially showers in the afternoon, are very frequent. No matter how fine the morning there is always a probability of a shower before night. The clouds are formed on the mountain tops and travel some distance eastward before breaking. Owing to the elevation, there is a possibility of frost on clear nights at any time of the year. The fall weather is, as a rule, very fine, especially during the months of October and November and, owing to the greater strength of the chinook winds, the winter is not so severe as in the prairie country.

The greatest asset of this district is the immense areas of coal beds. Seams up to fifteen feet in thickness have been found and worked and the coal is of good quality for steam purposes. There are possibilities for the development of water-power on the Brazeau and Southesk rivers, but on account of the abundant supply of coal, capable of being economically mined, such development is unlikely in the near future.

APPENDIX No. 37.

ABSTRACT OF THE REPORT OF T. S. NASH, D.L.S.

INVESTIGATION SURVEY IN SOUTHWESTERN MANITOBA.

On September 11, 1911, I was instructed to proceed at once to make an investigation of the survey monuments in township 2, range 21, west of the principal meridian. I accordingly left Ottawa on September 12 and arrived at Boissevain three days later.

This place is a thriving little town at the junction of the Great Northern and Canadian Pacific railways, and is surrounded by an excellent wheat-growing district. As threshing was in progress at that time I was able to secure the assistance of only one man in that vicinity, but after reaching the township where I was to work I obtained the help of another man with his horse and rig. The township is favourably situated for agriculture, being on the northerly slope of Turtle mountain. The northerly half of the township being prairie, was almost all under cultivation, more than half of the boundaries were fenced and many of the road allowances were improved, some being graded. The owners for the most part live in well-built houses of brick or stone, have excellent barns and fine stock and enjoy a very good telephone service. Practically all the monuments in the northerly half still exist or their positions are indicated by fences or crop lines. The southerly half of the township was formerly covered with heavy bush and only wooden posts were planted in the original survey. As this district has been repeatedly swept by fire, no trace whatever remains of the old lines or posts. The settlement in the southerly part is more recent. Much of the land has to be cleared of brulé and scrub before it can be broken, so that the proportion under cultivation is much less. A fine second growth of poplar is springing up in many parts under the protection from fire afforded by the cultivated areas. This is in marked contrast to the condition observed in the Turtle Mountain forest reserve in township 1 adjoining, where fires continue to keep all second growth eradicated.

The soil throughout the township is a black clay loam producing excellent crops of wheat, oats, barley and vegetables.

The lack of survey monuments in the southerly half of the township is a source of much dissatisfaction to the settlers, as they do not wish to do any breaking ground beyond their proper boundaries, nor to do any permanent fencing till they know where their boundaries are. As it is not known where the road allowances are, there is but one road, which is at all improved, opened through the bush. This lack of proper roads and bridges is a great drawback to the settlers as it is only with great difficulty that they can market their produce.

Having completed the search for monuments, I returned to Ottawa, arriving there on October 2.

APPENDIX No. 38.

ABSTRACT OF THE REPORT OF T. H. PLUNKETT, D.L.S.

LEVELLING ALONG FIFTH MERIDIAN AND ADJOINING BASE LINES AND MISCELLANEOUS SURVEYS.

My instructions were to complete a line of spirit levels along the fifth initial meridian from its intersection with Athabaska river in township 71 to the north boundary of township 112, over the twenty-ninth base line in range 1, and the twenty-eighth base line through ranges 1 to 17, inclusive. In addition certain corrections were desired on the meredian and some incompleted monuments were to be built.

The previous experience of surveyors showed that this country should be entered while the frost is still in the ground and preferably over the snow in early spring. Accordingly on March 14 I left Edmonton for Wabiskaw where I was to begin work, arriving there with my outfit and supplies on the 23rd.

I had intended travelling on the ice on Wabiskaw river, one hundred and fifty miles to its intersection with the fifth meridian, but owing to the great depth of snow early in the season, the ice was not strong enough to bear horses. As sufficient dog teams could not be obtained, we were compelled to wait until boats could be used. In the meantime we hired two dog teams and ran levels south from Wabiskaw along the fifth meridian to Athabaska river.

This work was completed on May 6 and the main camp was again reached on May 13. The boat which we had built was then loaded and sent in charge of my assistant to township 91, where the river intersects the meridian, while I with the remainder of the party ran levels north from Wabiskaw.

Considerable trouble was experienced navigating the river owing to low water, but by May 26 our provisions were safely stored at the intersection of the river and meridian in township 91, and the party reunited in township 83.

Our way ahead now seemed clear for at least ninety miles of work but about this date the almost incessant rains which characterized this season in the West commenced and very soon the swamps and muskegs began to delay us and continued to seriously hamper our operations as well as make life miserable for the party.

Work was carried on under these conditions until township 104 was reached. Here the swamps and muskegs became less numerous and although the rain continued until August 21 the wading through the foul-smelling swamp water was so greatly decreased that the party seemed to revive and take renewed interest in the work.

Peace river in township 111 was reached on September 6, and as our packhorses began to show the ill-effects from their long journey it was decided to give them a much-needed rest. Good pasture lands being convenient the remainder of the meridian north of Peace river, and the 29th base line, were completed without the aid of ponies, supplies and a limited camp outfit being packed by the men.

On our return to the 28th base line on September 20, our horses showed a great improvement and work was continued on the base line until October 2, when four ranges had been completed.

It was now considered advisable to commence our long journey homeward. Frost had come fairly early and the horse feed was not as good as it would otherwise have been at this date. The long trail between us and Edmonton made us doubtful if our horses would stand the journey if exposed to the severe cold which we would surely get if we remained later. Severe weather did overtake us even with our early start but fortunately not until we had reached Wabiskaw where hay was available.

On our arrival at Wabiskaw on November 4 we found that the season of 1911 had been the wettest for twenty years. Hay was scarce, it having been found impossible to cut the large meadows in the vicinity of Wabiskaw lakes owing to their flooded condition, while the continuous rains had prevented the proper curing of large quantities of hay obtained farther back from the settlement.

Regarding the agricultural adaptability of the country traversed by me this season, little need be said. The report of Mr. A. W. Ponton, D.L.S., appearing in the annual report of the Topographical Surveys Branch for 1908-9, deals fully with this question. A copy of that report I found invaluable to a stranger penetrating this wilderness, and, having referred to it constantly during my trip, I can fully endorse his views on the suitability of this country for agriculture. The general information supplied by him regarding the country was found most accurate and greatly facilitated our work this season.

According to the present inhabitants of this district the spring of 1911 was unusually late. Growth at Wabiskaw did not commence until May 15, and it was almost June 1 before any green feed was available for horses north of Wabiskaw, but on May 6 grass had attained a growth of four inches at the intersection of the fifth meridian and Athabaska river in township 71. Once commenced, however, the grass and foliage came out rapidly and by June 20 these were at their best.

Frost at night continued until May 29, but after that date no frost was noticed, with the exception of a degree or two on July 20, until August 25 and 26, when a severe frost occurred in township 109, which seems to have been general.

September was, generally speaking, a fine month. Frost at night occurred on the 9th, 18th, 19th, 20th and 21st, while on the 20th snow fell to a depth of three inches, but this was all gone on the 23rd.

October, until the 18th, was exceptionally fine, frost occurring only on the 2nd, 3rd and 4th. On the 18th we experienced a severe northwest gale, snow falling to a depth of six inches on the high land in township 95, and after that date frost was experienced nightly while the swamps were frozen sufficiently to bear ponies after the 25th.

November was very cold, snow falling to a depth of four or five inches on the 6th, 7th and 8th, with the thermometer at zero at Wabiskaw. The weather became steadily colder until the 15th when 40 degrees below zero was experienced by the party on the summit of Pelican mountains; after that date, however, the weather moderated although winter weather prevailed throughout the month.

The spring of 1911 came on very dry. No rain fell during April, and May, with the exception of light showers on the 5th, 9th and 29th, was also dry. A violent rain and hail-storm occurred on June 2 which flooded the swamps and muskegs rendering the pony trails very heavy and in places impassable. In June there were twelve days during which heavy rains occurred and July was also very wet, rain falling on seventeen days, while during August rain fell on every day of the first twenty except the 19th. The remainder of the month was fine and comparatively dry.

It was found that comparatively small areas along the meridian are at present fit for settlement and these locations are at present so isolated and so difficult of access that it is highly improbable that settlers will find their way to them over the route followed by me this year.

Many first-class locations are to be found north of township 104 and west along the 2Sth base and these are easy of access compared with the country between Wabiskaw post and township 104.

Practically the whole country as far north as township 106 is covered with moss from six inches to two feet in depth. This moss has prevented the water from draining off the land, acting very much like a huge sponge, and has given it its swampy nature. The fact that so much of this swamp and muskeg exists should not lead to the conclusion that it is a flat country, presenting difficult drainage problems. This is not at all the case and the presence of the greater number of these wet areas

is in my opinion altogether accounted for by the presence of the moss. I have found in many places almost impassable swamps on slopes of from ten to fifteen degrees. In some localities where forest fires have occurred during very dry seasons the moss is removed and the country is now dry and ready for settlement.

While at the confluence of the Red and Peace rivers I was told by the Hudson Bay manager there that the Indians in that country are burning a crude oil but the location of their supply is as yet known only to themselves. An attempt to obtain samples of this oil was unsuccessful.

Game is abundant. Prairie-chickens were seen as far south as Wabiskaw while grouse were very numerous all along the meridian and from township 100 north. Rabbits too are much more plentiful than for some years previously and this according to the fur traders bespeaks a much larger yield of fur in the near future.

All through the country the beavers are rebuilding their dams and appear to be increasing rapidly in numbers. Moose, caribou and bears appear to be plentiful except north of Peace river where the Indian hunters complain of the ravages of wolves among the young caribou and moose. No wolves, however, were seen by the party.

APPENDIX No. 39.

ABSTRACT OF THE REPORT OF A. W. PONTON, D.L.S.

SURVEY OF PART OF THE PRINCIPAL MERIDIAN.

On March 2, having completed my organization and secured the necessary outfit including dogs and dog-sleighs, we took train from Selkirk to Gimli, where supplies had already been forwarded. There two teams of horses with bob-sleighs awaited us, and on March 3 a start was made for the North.

The route followed was from Gimli to Icelandic River settlement by ice, from Icelandic River by trail across country to Fisher Bay settlement, from Fisher Bay on the ice following the west shore of the bay to Stony point and around this point to my starting place on the meridian in township 35. From Gimli to Stony point there is a well-established winter road followed by freighters hauling fish from Outer Sturgeon and Reindeer islands to Gimli, and stopping places occur at intervals of about fifteen miles. On the 13th a start was made on the meridian and work proceeded until the 20th, when I decided to dispense with the services of six dog teams and their drivers, as it had become evident soon after passing Berens island that it would be impossible to obtain a sufficient supply of fish to feed the nine teams of dogs with which I had started.

Having reduced my transportation to three dog teams, the line was continued from day to day as the weather conditions permitted until the mainland on the north side of Big Black River bay in section 36, township 48, was reached on April 4.

On the 5th an attempt was made to produce the meridian on the mainland, but the snow was found to be too deep in the bush and too wet to proceed farther with the limited means of transportation at my disposal. At the same time I had been compelled to cache the greater part of my supplies far behind on Burton island. These supplies could not be brought up unless we could depend on the winter temperature continuing late into the month.

Having decided to return to Selkirk to await the opening of navigation, and to obtain a party and outfit, including canoes, suitable for carrying on the work under summer conditions, I started for the south on April 6, reaching Berens river on the 8th. There my dog trains were dispatched to Burton island to secure supplies and iron posts from cache, and on their return these were stored at the Hudson's Bay company's post, a port of call for steamers. Burton island can be approached only by tugs. I was delayed a couple of days at Berens river, owing, first to water on the ice, and then to a violent blizzard, but on the cessation of the latter the water had disappeared off the ice and on the 15th a start was made for Gimli, which was reached without incident on the 20th. On the following day we arrived at Selkirk, where my small party was paid off, with the exception of my two assistants. The chief incidents of such a campaign on the ice are blizzards and snow-blindness. I was fortunate with regard to the former, being actually caught only once without some shelter other than that which a tent affords, but with regard to snow-blindness, the picket man and myself were the chief sufferers, owing to the constant necessity of removing our coloured glasses.

The opening of navigation was unusually late in the spring of 1911, owing to the low temperature which continued throughout the month of May, and it was June 6 before I could get passage by steamer to Big Black river. Work was resumed on the meridian on the 10th and continued without interruption, other than delays caused by difficulties of transportation, until September 28 when the sixteenth base line was reached. During September the weather was cold and disagreeable, rain falling on seven and snow on two days. The country being generally floating muskeg, ice would form at night which had to be broken with the feet at every step, and much

endurance was required to stand in ice cold water all day. Transportation was thus rendered almost impossible, and supplies could no longer be kept up at this particular season. With the limited supplies on hand, I decided to make an effort to run the sixteenth base line far enough west to interseet Nelson river, or for about six miles, with the view to making both the meridian and the base line more accessible whenever their further production might be required. However, after running it nearly two miles, bad weather in the form of rain, snow and fog, caused delay which threatened to bring about a famine, and it became necessary to pick up our packs and make for the river to get in touch with Norway House by means of canoes as soon as possible. I had also, previous to this date, received notice from the Northern Fish company that it would be necessary for my party to be at Warren's Landing by October 11 to catch their steamer *Wolverine*, which would make her last trip to Selkirk on that date.

Arriving at Nelson river on October 1, we waited till the 5th for the arrival of a motor boat from Norway House. After proceeding up-stream in this boat for a couple of miles the motor failed, but by good fortune a York boat happened along and by travelling all night we were enabled to reach Norway House on the morning of the 6th. From this post we travelled by the Hudson Bay steamer *Highlander* to Warren's landing, and from there by the steamer *Wolverine* to Selkirk, where my party was paid off.

The country along the meridian between townships 48 and 60 was found to be all of the same general nature—low, with swamps and muskegs alternating with outcrops of rock of the Laurentian formation. These outcrops invariably run in a northeast and southwest direction. Patches of dry ground covered with spruce from two to eight inches in diameter were occasionally met with, but in no case were they observed to cover any large area. The soil in such cases was sand or frozen clay. The soil throughout is generally black vegetable muck, which, even in event of draining, cannot be regarded as suitable for agriculture. Along the banks of the Belanger, Gunisao and McLaughlin rivers occasional patches of sandy loam occurred where farming could be followed on a small scale.

The country is timbered wtih spruce, jackpine, tamarack, poplar and birch, but in no instance was it found of sufficient size for milling purposes. Evidences of recent fires were observed, but on the whole they have not spread far owing to large areas of open muskeg. Timber cannot reach a greater growth than six to eight inches, as the roots rest on perpetual ice. In view of the approaching scarcity of timber, the drainage of this country may be a profitable investment at no distant date. Jackpine is confined to the rock areas, but none of sufficient size for railroad ties was observed.

There are apparently no beaver meadows and the only hay is muskeg grass.

The water is generally very clear and good, and this applies even to the muskegs. Few creeks were crossed, and all were small. Belanger, Gunisao and McLaughlin rivers are fine streams averaging one hundred feet in width. These streams are of varying depth and have no perceptible current, except in the vicinity of small falls, which occur at intervals.

Water-powers with heads of from two to ten feet can be obtained on these rivers, with apparently a permanent supply of water.

The climate cannot be judged by the weather conditions of 1911, as they were unusual throughout Manitoba, Saskatchewan and Alberta, a late spring being followed by poor ripening weather. Potatoes of excellent quality are grown at Norway House.

This district lies within the Laurentian area, and the rock, being massive and without cleavage, is not generally suitable for building purposes.

No minerals of economic value were observed and the Laurentian rocks seem unpromising in that direction.

Game of the feathered variety is plentiful. Ducks abound along the rivers in their season. Several cow moose were seen and, I understand, that both moose and caribou are numerous.

Fish is the staple food of the Indians and the supply seems to be always plentiful.

APPENDIX No. 40.

ABSTRACT OF THE REPORT OF R. C. PURSER, D.L.S.

MISCELLANEOUS RESURVEYS IN MANITOBA, SASKATCHEWAN AND ALBERTA.

A considerable portion of the season's work consisted of the survey of lakes which had never been plotted and in the investigation of lakes that had wholly or partly dried up since the original survey. To the former class belong the surveys made in township 25, range 9, west of the principal meridian, township 38, range 19, and township 33, range 21, west of the second meridian, township 42, range 2, west of the third meridian, township 43, range 1, township 45, range 2, township 44, range 5, and township 41, range 9, west of the fourth meridian. To the latter class belonged the surveys made in township 6, range 9, west of the principal meridian, township 38, range 19, west of the second meridian, and township 36, range 2, west of the third meridian.

In township 6, range 9, west of the principal meridian a lake was found to have almost completely dried up which at the time of the original survey had contained about 400 acres. Upon the completion of a drainage ditch which was in the process of construction at the time of our survey, the remainder would soon be rendered totally dry and fit for agricultural purposes.

Retracements were made in township 8, range 31, west of the principal meridian, and township 34, range 3, west of the third meridian. In the former over fifty-two miles of line were retraced.

Some monuments were corrected in townships 5 and 25, range 29, west of the principal meridian, and township 43, range 4, west of the fourth meridian.

An investigation of duplicate monuments was made in township 39, range 1, west of the third meridian, and of lost monuments in township 49, range 20, west of the fourth meridian. It was while engaged on this latter work that cold weather and deep snow came effectually concealing any remains of lost monuments there may have been here and forcing us to close the season's operations. In township 5, range 7, west of the second meridian, the east boundary of section 34 had been omitted from the original survey. This was run and the quarter section monument established.

In township 52, range 20, west of the fourth meridian, an original survey was made. This township was formerly all included in the Cooking Lake forest reserve, but recently the southwest portion was withdrawn; this part was subdivided. Almost all of the part surveyed had been squatted upon. One man had cleared and cropped as much as thirty-five acres in the last three years and had erected a very comfortable two-storey house as well as stables and drive shed. This township is about thirty miles easterly from Edmonton on the Grand Trunk Pacific railway and is becoming increasingly popular as a summer resort for the residents of that city. In Cooking lake itself, there is good fishing and the region is also well suited for duck and partridge shooting.

In township 36, range 6, west of the third meridian, three islands in the immediate vicinity of the city of Saskatoon which had not previously been surveyed, were traversed. The largest of these islands was wanted by the city of Saskatoon for park purposes.

APPENDIX No. 41.

ABSTRACT OF THE REPORT OF C. RINFRET, D. L. S.

MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

Having organized my party at Moosejaw I left that place on May 6, 1911, for the scene of my first survey work. This consisted of the retracement of townships 16, ranges 21, 22, 23 and 24, west of the second meridian.

These four townships are situated in the best grain growing district in southern Saskatchewan, and are very well settled, only a few railroad sections being uncultivated. The main line of the Canadian Pacific railway runs through townships 16, ranges 23 and 24, and very close to the other two townships. Lack of good water is the greatest drawback, it being impossible to obtain water in some cases even by drilling hundreds of feet.

I next retraced townships 17, ranges 18, 17 and 16, west of the second meridian, in the order named. The land in ranges 18 and 17 is sandy and undulating, and generally second-class, while that in range 16 is very good, although partly covered by brush and sloughs. Very little of the later township is under cultivation but all the even-numbered sections are taken up.

After resurveying nine miles in township 19, range 17, I moved to township 15, range 23, which I resurveyed. This township has good soil and is well settled. Water can be easily obtained from Moosejaw creek which crosses the township, and a branch of the Canadian Pacific railway runs through the town of Drinkwater situated in the northern part.

A retracement was then made of township 16, range 26, in which the city of Moosejaw is located, and a few miles of retracement was performed in townships 17 and 18, ranges 25 and 26, and township 18, range 27, west of the second meridian.

A start was made for townships 14 and 15, range 28, west of the third meridian. In this district the surface is rolling with a sandy loam soil which gets heavier in the northern part. The south third of township 14 is composed of worthless quicksand, and although half of the township is taken up only a small portion is cultivated.

I finished the survey of these townships on August 29 and moved to township 26, range 16, west of the fourth meridian, going via Bassano, a village of about five hundred inhabitants. This place has grown up within the last two years since the Canadian Pacific railway have constructed a large dam on Bow river for irrigation purposes about three miles to the southwest. About two-thirds of this township is fairly level and the soil is good.

The southwest part, across which Red Deer river flows in a valley four hundred feet deep, is cut up by coulees which render it useless for farming. After traversing a lake in township 28, range 15, I left for township 26, range 9, west of the third meridian, which I resurveyed. This township is in one of the best grain growing districts, and was the only place visited where the crops did not suffer from frost. Although over fifty miles from any railroad it is being settled rapidly. Wood is still used as fuel but the supply is limited.

After surveying nineteen miles in township 22, range 6, west of the third meridian, I returned to township 16, range 25, west of the second meridian, and made an investigation for duplicate monuments. I continued the investigation in townships 14, 15 and 16, range 24.

A heavy fall of snow followed by extremely cold weather forced me to abandon work in township 14, range 24. I accordingly stored the outfit at Moosejaw and left

for Kamsack. With my assistant and one man I surveyed parts of township 29, range 31, and townships 32, ranges 32 and 33. I also traversed a portion of Assiniboine river.

After surveying one mile in township 25, range 29, and traversing Shillingthorpe lake in township 26, range 31, west of the principal meridian, I made an investigation survey in township 30, range 14, west of the second meridian, after which I closed operations for the season.

APPENDIX No. 42.

ABSTRACT OF THE REPORT OF E. W. ROBINSON, D.L.S.

SURVEY OF PART OF THE SECOND MERIDIAN.

The northeast corner of township 61 on the second meridian, which was the starting point of my survey, was reached on July 25, 1911, the party having travelled from Le Pas by steamer to the mouth of Sturgeon river, and from there by canoe to the meridian.

Namew lake is a fine body of water connected by English and Whitey narrows with Cumberland lake. The shores are mostly well timbered with spruce, tamarack, jackpine and poplar up to ten inches in diameter. It is well stocked with fish, the principal varieties being lake-trout, whitefish, jackfish and pickerel.

Sturgeon river throughout its entire length from Amisk lake to its outlet at Namew lake is treacherous for canoe travel, as the current is swift and there are numerous rapids. A large quantity of freight for the North passes by this route and at certain stages of the water it is possible to run the whole length in York boats. There is a narrow strip of good land on each side of this river varying from five to thirty chains in width, suitable for agriculture. The soil is a sandy loam with spruce, tamarack and poplar up to eight inches growing thereon. On July 26 I commenced work on the second meridian in township 62. There is some good spruce here up to twenty-two inches, with tamarack, jackpine, poplar and birch up to eight inches. The soil is a sandy loam with considerable rock in places. The high land extends to the west about two miles and then drops suddenly into the extensive muskegs which lie to the south of Amisk lake. Sturgeon river was crossed in section 13, and on the north side of the river the line soon entered an extensive muskeg. Small spruce and tamarack cover the whole area, and narrow ridges, three or four feet higher than the surrounding muskeg, are found at intervals. These ridges carry spruce, tamarack and jackpine up to eight inches. Most of the muskeg has a hardpan or rock bottom, and very few are of the floating variety. It is worthy of note that in digging the pits for the monuments at corners, frost and ice was usually encountered at a depth of ten or twelve inches. The maximum daily temperature at this time was about 75° or 80° Fahr., but the upper layer of dry moss on the muskegs acts as a very efficient non-conductor of heat. The nights were invariably cool as one would expect and summer frosts were of common occurrence. If the muskegs were drained and cultivated, and I am of the opinion that they could be made into excellent hay land, the soil would absorb heat during the day, and this being radiated gradually throughout the night, would overcome these summer frosts. About the centre of section 1, in township 63, the line enters a stony ridge well timbered with jackpine, poplar, spruce and tamarack up to ten inches in diameter. Small patches of swamp are distributed throughout. This ridge extends to the shore of Mari lake and lies generally to the southeast of this lake. A fair amount of pulp-wood could be obtained here and some logs are large enough for milling purposes. Mari lake is about seven miles long and from one and a half to three miles in width. Its waters are well stocked with mari from which it obtains its name, whitefish, jackfish and pickerel. From the lake there is a water route leading from the southwestern corner to Amisk lake, and from a bay in the east side to Athapapuskow lake, or Papuskow lake as it is sometimes called. A water route does not necessarily mean direct water connection but oftimes a string of lakes connected by portages. North of Mari lake the country becomes higher, while rocky and sandy ridges are the common features and these

are covered with small poplar, jackpine, spruce, tamarack and some willow. These ridges are from fifty to two hundred and fifty feet high, the approach sometimes being gradual, but oftentimes a precipitous rock bluff. Muskegs and swamps have a rich black muck soil and clay subsoil, and small lakes occur between the ridges. In townships 64 and 65 the limestone formation changes to granite, and several discoveries of mineral have been reported on the contract between these two formations, iron pyrites being seen at several points. The granite is seamed with small veins of quartz and quartzite, and 'iron cappings,' which are considered to be sometimes an indication of mineral, are common. In section 12, township 65, we crossed Sucker creek which flows into Amisk lake. This is a main route of travel to the east and northeast. The country continues of the same description except that the lakes have rocky shores. No timber of milling size was found with the exception of odd trees, but there is a large quantity of spruce up to eight inches in diameter suitable for pulp-wood. Mixed with the spruce there is jackpine, tamarack, poplar and birch averaging from six to eight inches. Echo lake was crossed in section 25, township 65. North of Echo lake the rock ridges become more broken, but the country is generally of the same description. The multitude of small lakes in this country is worthy of notice. It was difficult to map all the lakes even close to the line, and east and west they seemed as numerous. From the top of any rocky ridge it was the ordinary experience to be able to see three or four small lakes. In section 1, township 67, a change occurred in the timber, and we entered brulé country. The fire happened about twenty-five years ago and covered a very extensive area. It took place during a very dry season and not only destroyed the timber, but burnt what little soil there was on the ridges. Small jackpine, spruce, and birch are now growing up. In section 25, township 67 we crossed a creek about seventy feet wide which I believed to be the one that I heard ran into Wildnest lake. It was explored for some distance but the lake was not found. Our provisions were now very short so I determined to discover this lake if possible. I left camp with my explorer and we travelled to the northwest and north for three days. Many lakes were found, some large and some small, but we were compelled to turn back without finding Wildnest lake, as I knew that by this time the provisions in camp, even on short rations, were barely sufficient to take us back to Amisk lake where I had a small cache. On October 7 I therefore started back. Trying to find a shorter route to Amisk lake I came across a strip of fine spruce approximately in section 23, township 66, range 1. The trees ran from twenty-four inches to thirty inches in diameter; the belt was about thirty chains in width where it was crossed and in length it seemed to extend for a considerable distance. We reached the cache on Amisk lake during the afternoon of the 8th, where I had left enough provisions to take the party to Le Pas. It was a sad disappointment to hungry men to find that the cache has been robbed and that all the meat, sugar, jam and [illegible] had disappeared. Fortunately some flour, beans, and a little butter was left. I was now compelled to send to Wildnest lake for some provisions by the Sturgeon Weir river route—a long and arduous trip. I therefore despatched six men with my assistant in charge and they made the round trip in eight days, arriving back on October 16. The weather was very stormy and I hesitated to risk canoes on Amisk lake. However on the 18th we made a start and arrived at the mouth of Tearing river on Cumberland lake on the 23rd. The weather was now cold, some snow had fallen and the shallow bays were freezing at nights. I accordingly left my camp and outfit at Tearing river and on the morning of the 24th left by canoe for Le Pas. I travelled by the Tearing river and found that this passed through a low swampy country. The banks are lined with grey willow, cottonwood and some water-birch. There was considerable water in this river and only two short rapids. I heard subsequently that the steamboat is able to use this channel in high water. I arrived at Le Pas during the afternoon of the 25th and commenced arranging my outfit for the winter's work on the fifteenth base line. Winter had now set

in and the marshes, swamps and small lakes were frozen. Saskatchewan river was carrying slush ice, but it was November before it was frozen across.

During this season's work we did not see any large quantity of land immediately available for agriculture. Most of the swamps and muskegs if drained would make excellent hay land and some root crops would do well. The climate was on the whole favourable with plenty of sunshine, and although summer frosts were experienced these I believe could be overcome through cultivation. At Cumberland House on Cumberland lake all vegetables do well, and the fact that tomatoes are raised successfully year after year is sufficient evidence as to the climate. The winters are similar to those of Manitoba but with a heavier fall of snow, from two to three feet being the usual quantity. Through most of the district traversed we found spruce and poplar suitable for pulpwood, with larger milling spruce close to Amisk lake. Fish are plentiful in all lakes except the small marshy ones. Amisk lake in particular has the reputation of supplying the largest and finest whitefish in this section of the country, and also has in its waters jackfish, pickerel and lake-trout Cumberland lake is rapidly filling up with the sediment brought down by Saskatchewan river and here the fishing is poor. Jackfish and goldeye are the most common varieties obtained and at certain seasons even these are scarce.

SURVEY OF PART OF THE FIFTEENTH BASE LINE WEST OF THE SECOND MERIDIAN.

On November 23 I left Le Pas for the survey of the fifteenth base line, travelling by the Cut Off and Saskeram lake to Tearing river where I camped. At this date winter had well started. The rivers and lakes had frozen over and about fourteen inches of snow covered the ground.

I experienced considerable difficulty when organizing my party at Le Pas in obtaining a sufficient number of dog trains. There has been a great demand for dogs during the last few years by survey parties locating the Hudson Bay railway, and they are accordingly scarce and of inferior quality.

I commenced work on November 29 at the northeast corner of section 36, township 56, range 1, west of the second meridian, which falls in one of the large willow marshes so characteristic of Saskatchewan river valley. On the west side of this marsh is a good belt of spruce, jackpine, tamarack, poplar and birch, averaging twelve inches with occasional spruce up to sixteen inches in diameter. Small swamps and patches of brulé are found throughout this area. The base line crosses Tearing river in section 33. This river varies from five to thirty chains in width and in places has many channels separated by islands. It is an outlet from Cumberland lake to Saskatchewan river and runs through a low marshy country, which within comparatively recent years was a bay of Cumberland lake. At present Tearing river carries a considerable quantity of Saskatchewan river water which will be explained more fully subsequently in this report.

West of Tearing river the base line continues through a marshy country, until in section 35, township 56, range 2, it enters the fringe of timber along the old channel of Saskatchewan river. This belt runs from five to fifty chains in width and consists of large cottonwood with some good spruce, poplar, birch and elm. I made an attempt here to connect the Cumberland Indian reserve to the base line, but found that the boundary lines of the reserve ran through marshes, and with the snow on the ground it was impossible to definitely locate the lines and corner posts. I made enquiries on the reserve and no one seemed to know the exact location of the corners, but I was informed that in the summer-time a post, or the remains of one, could probably be shewn me. As I had already delayed my party I considered it advisable to postpone this work until next summer when I would be passing this point. On the west side of the channel the line crosses a similar belt of timber and then emerges into the extensive area of willow swamps, hay meadows and shallow lakes which lie to the south of Saskatchewan river. Large numbers of muskrats are to be found in these

swamps and it is a famous rat-hunting ground for the Cumberland Indians. The base line continues in these swamps through ranges 2, 3, and 4. In range 5 a few ridges of higher land were encountered with spruce, tamarack, birch, poplar and cottonwood growing thereon. These ridges are separated by large willow marshes. The old channel of Saskatchewan river was crossed again in range 6 and on the west side some excellent spruce and tamarack was found. The spruce ran up to twenty inches in diameter and the tamarack to eighteen inches. There is also considerable tie timber and pulp-wood there. One lake and several marshes divide this timber belt into different sections. To the north of this belt lies an extensive area of swamps and shallow lakes through which run several old channels of Saskatchewan river.

At the commencement of range 8 we crossed Torch river which is now the main channel of Saskatchewan river. Some years ago during a season of very high water Saskatchewan river broke through its left bank in section 2, township 56, range 8, now known as the 'Cut Off,' and, cutting a channel into Torch river, found its way into Cumberland lake. A sand bar formed across the original channel and now only during high water can this old channel be used for navigation. In fact from August of each year there is barely enough water for canoe travel. For the first few years after the river changed its course it took a channel through townships 57, ranges 7 and 6, into a long bay at Cumberland lake. Owing to the current being checked by meeting the water of Cumberland lake the matter held in suspension, and Saskatchewan river in flood time carries an enormous quantity, was deposited, and rapidly filled up this bay; consequently the river was forced to seek new outlets to Cumberland lake. Many new channels were formed but were quickly filled in. A few years ago a channel was cut entering Cumberland lake at Pine Bluff, and at present the bulk of the Saskatchewan water flows this way. The water from Cumberland lake has two outlets into the original Saskatchewan channel, viz. Big Stone and Tearing rivers. Both these rivers have rapids in their course but are navigable most of the summer season for small steamboats. About twenty-five years ago a bay of Cumberland lake stretched to the southeast along the present course of Tearing river. This is now filled in and Tearing river pursues a tortuous course through swamp lands and hay meadows. During the season of extreme high water the whole of this section of the country, with the exception of a few high points, is flooded. A considerable quantity of suspended matter is deposited during each of these floods and many shallow lakes have been first marshes and then hay meadows within the lifetime of some local residents. The soil is a rich black muck on a hardpan or rock bottom. If the summer floods of Saskatchewan river were controlled and drainage of a comprehensive nature undertaken, a considerable area of country, now the abode of the muskrat and bittern, would become available for settlement.

The base line was continued through range 8 and Torch river was again crossed. The banks are well timbered with spruce up to fourteen inches in diameter, cottonwood and tamarack to eighteen inches and white poplar and birch. South of Torch river the country is swampy with the exception of one ridge carrying spruce, tamarack and poplar. There is also a well-defined ridge of the same class of timber stretching to the north. I had a cache of supplies established on this river last summer and the line passed within ten chains of it. The success of this winter's work is largely due to the fortunate placing of this cache. To prevent delay in base line work it is essential that a cache be established ahead on the line and when a surveyor is fortunate enough to have one well placed he realizes how it assists the work.

Torch river was again crossed in range 9. South of the line lies an extensive spruce and tamarack muskeg. Along the river the fringe of spruce, tamarack and poplar continues and the soil is an excellent sandy loam. There is a nice strip of spruce up to ten inches in diameter lying along a small creek entering Torch river from the north in section 11. To the north the country is generally a spruce and tamarack muskeg with bluffs of spruce and tamarack up to eight inches on the higher land. At the commencement of range 10 a tributary of Torch river was crossed and

along both banks was found some excellent spruce, tamarack and white poplar up to fourteen inches in diameter. The timber is clean and well suited for ties.

This creek averages about one hundred and fifty feet in width and apparently has a swift current with many rapids. From an examination of the timber along the bank there is evidently a large volume of water flowing when the stream is in flood. West of this creek it is spruce and tamarack muskeg, with narrow ridges covered with jackpine, tamarack and spruce up to eight inches in diameter. Most of the muskeg is what is known as 'dead' muskeg, but there are some open swamps. The trees are very stunted on these muskegs and evidently have a hard struggle to survive. One spruce tree two and one-half inches in diameter was examined and its annular rings showed it to be one hundred and twenty years old. This kind of country continues through ranges 10 and 11, and for a considerable distance north and south of the base line. In section 31, range 12, a creek was crossed which proved on exploration to be the same one that was crossed in range 10. There was still some fine timber about its banks, the principal varieties being spruce, tamarack and cottonwood trees eight to fourteen inches in diameter.

Passing into range 13 the line again enters spruce and tamarack muskegs while to the south of the base lies a large open swamp. The spruce and tamarack muskeg continues to the north and is crossed by sandy ridges carrying jackpine and spruce up to eighteen inches in diameter. Proceeding westerly through range 14, the country rises somewhat and the ridges become more prominent. South of the line is an area of spruce from six to eight inches in diameter suitable for pulpwood. Jackpine and spruce up to eight inches were found on the ridges. Between the ridges there was the customary spruce and tamarack muskeg with patches of open swamp. A well-defined ridge of small jackpine was crossed at the commencement of range 15, and west of this a large open muskeg about seven miles long by three miles wide.

Farther west again the country rises and the ridges, covered with jackpine and spruce averaging six inches in diameter, are more pronounced. Between the ridges tamarack and spruce muskegs are found. To the southwest could be seen a range of hills trending in a northwesterly direction.

Through range 16 the low sandy ridges continue, becoming higher toward the western part of the range. Small jackpine cover the summits of the ranges with small spruce, tamarack, and some poplar and birch on the slopes. The usual muskegs and swamps are found between the ridges. In the eastern part of range 17 the base line crosses a well-defined range of sand hills covered with small jackpine. South of the base line the hills have a general trend to the southeast. To the north of the base line they run to the northwest for about three miles and then turn due north for about nine miles, where a range of hills from the west joins. They are partially timbered with small jackpine, large patches of snow showing up prominently from a distance. The lower slopes of these hills have small jackpine, spruce, tamarack, poplar and birch. In section 33 a small creek was crossed and to the west of this the country again rises into rolling, sandy, jackpine ridges. In section 31 two small creeks were crossed which join, and flowing a little to the east of south enter White Gull creek, which empties into Torch river. In section 35, range 18, the base line crosses the located line of the Hudson Bay Pacific railway, which commences at Prince Albert. This line follows a well-defined ridge timbered with small jackpine, spruce, tamarack, poplar and birch. A fire ran through this section of the country a few years ago and destroyed some good jackpine, spruce and tamarack. The soil is generally a light sandy loam with some areas of good clay loam in the lower places. If this railway line is constructed, some good agricultural land will be available for settlement along this ridge. At present the only means of access is by a wagon road leading from Fort a la Corne. This road crosses the base line in section 33, range 18, and passes to the south through a rolling sand-ridge country with brulé, windfall and second-growth jackpine. The brulé

country continues through range 19 with small jackpine, spruce and poplar now growing up. The soil is a light sandy loam with some patches of heavier soil. In section 31 we crossed White Gull creek which flows to the southeast emptying into Torch river. A range of hills shows up prominently to the north, distant about ten miles, and extensive muskegs lie along the base of these hills. In range 20 more muskegs are found with scattered small spruce and tamarack. White Gull creek runs to the north of the base line and with its tributaries drains the area between the line and the range of hills to the north. Entering range 21 the land becomes somewhat drier, especially to the south, the rolling sand-hills so characteristic of this section of the country being noticed. North of the line is White Gull lake, a body of water about six miles long by two miles wide. The southern shore is marshy, but the northern shore is somewhat bolder. To the north of the lake is a range of low hills, carrying some fair spruce and poplar up to ten inches in diameter. There is a trail about six miles long running between Candle and White Gull lakes. In summer, however, travel over it is difficult owing to the many muskegs crossed. This trail intersects another one which runs from Candle lake north to White Swan lake. On March 13, having completed range 21, I decided to cease work for the season. The weather had turned warm, the snow had gone from the south side of some of the ridges and transportation was accordingly difficult.

I brought the outfit out by following the White Gull trail to Candle lake and thence across Candle lake to the fish camp on the west side. The trail then crosses the narrow strip of land between Candle lake and Little Candle lake and follows the east shore of the latter lake to its southeastern corner. From this point an excellent wagon road runs to Prince Albert. Some good spruce, poplar, tamarack and birch were found along the road until we neared Fox plains where the country has been burnt. There we passed the first settlement and the homesteaders reported that they expected an influx of new settlers in the spring when there would be a demand for homesteads farther north along this road. During the summer time this road is sometimes difficult to travel owing to wet places. We reached Prince Albert on March 17, and from there proceeded to Le Pas where I disbanded the party.

Generally speaking the timber in the section of the country traversed by this base line is not large enough for milling purposes. The eastern part of the base line runs through a swampy and muskeg country, comparatively little land being dry enough to support timber of any size. In township 57, range 1 is a scattered belt of spruce up to sixteen inches with jackpine, tamarack, poplar and birch. Along both banks of Saskatchewan river one finds spruce, poplar, tamarack, cottonwood, birch and elm. This strip varies from a few chains to fifty chains in width and there are many places where logging could be profitably conducted, although the patches of merchantable timber are small. In range 7 we crossed an area of first-class spruce and tamarack, the timber being clean and sound. Along Torch river in range 9, and its tributary in range 10, we found spruce, tamarack and poplar from ten to fourteen inches. Much of this timber would be suitable for ties, and Torch river could be used to drive them down to Saskatchewan river. The tributary of Torch river was again crossed in range 12, and similar timber was found along its banks. There are, however, many rapids on this creek and driving would be difficult. This was the last timber we crossed of immediate market value. On some of the ridges farther west there are small areas of spruce suitable for pulp-wood and some tamarack of small size.

The fishing in Cumberland lake is yearly becoming of less importance owing to the lake filling up. The other lakes passed are all too shallow for fish, except White Gull lake in ranges 21 and 22, which is reported to be well stocked with jackfish and pickerel. Game is plentiful, moose and caribou being found in considerable numbers. Fur-bearing animals are fairly numerous, the principal varieties being marten and lynx.

APPENDIX No. 43

ABSTRACT OF THE REPORT OF O. ROLFSON, D.L.S.

SURVEY OF THE TWENTY-SECOND BASE LINE ACROSS THE PEACE RIVER BLOCK.

I left Edmonton on March 2 and travelling via Athabaska Landing, Grouard and Peace River Crossing, reached Dunvegan on the 25th. Sleighing was good all the way except along the prairie south of Peace River Crossing, where the snow was fast disappearing. The ice was followed from Athabaska Landing to Grouard (except for ten miles east of Sawridge) and also from Peace River Crossing to Dunvegan.

As the ice above Dunvegan was considered unsafe, one of our freighters having broken through, we decided to follow the trail leading to Fort Grahame. This trail, cut by the Royal Northwest Mounted Police during the Klondike rush, leaves the overland route from Peace River Crossing to Dunvegan at a point about ten miles north of the latter place, and, going north and west, leads to Island lake where there is an Indian settlement. From here the trail runs northwesterly through beaver meadows, scrubby prairies and poplar bluffs to a large prairie on the east side of Clear river. This prairie, over three hunded acres in extent, is surrounded by poplar and spruce, with a lake at the south side.

After crossing Clear river the trail runs southwesterly crossing several streams with valleys three hundred feet deep and passing through spruce and jackpine woods till Boundary lake is reached. This lake is about one mile wide and two miles long with grassy shores along which a great amount of medium quality hay could be cut. The trail runs west from Boundary lake through spruce, poplar, jackpine and open prairie, crossing North Pine river at the mouth of Fish creek. During low water the river is about two feet deep, but at high water a man must swim his horses and raft his supplies from the upper ford about two miles up the stream. The valley is over six hundred feet deep and the grades are very steep. South of the valley of Fish creek the country is level and after travelling ten miles through light poplar and open prairie, Fort St. John, lying at the foot of the hills on the north side of Peace river, is reached.

From Fort St. John to Fort Grahame the trail, which is not much better than a widely cut pack-trail, is much rougher and crosses numerous deep valleys. The bridges across the streams are in bad repair and many of the grades are washed away.

We reached Boundary lake on April 27, and after building a cache we commenced our work from the northeast corner of township 84, range 13, west of the sixth meridian, as established by Mr. J. R. Akins, D.L.S. We ran the east boundary of townships 84 and 83, in range 13, and the jog on the correction line to the line run from the south, thus locating the northeast corner of township 83, range 13, west of the sixth meridian.

This east boundary almost immediately runs into a spruce and tamarack swamp, extending for two miles, then through heavy spruce and poplar timber grown up with young poplar and jackpine. With the exception of one or two small areas which have been burned oftener and are now grown over with poplar, this continues as far south as the correction line. All along the jog the timber is mostly poplar, the country undulating and well watered by good fresh water streams.

After completing the meridian we moved north and commenced work on the twenty-second base line which we completed on October 13.

This line through ranges 13, 14, 15, 16, and 17, passes through undulating country, the surface of which is covered with spruce, jackpine and poplar with

occasional openings of scrubby prairie. This scrubby prairie and light poplar country is the result of fires destroying the original timber. The soil is a good clay loam with grass, wild vetch and pea-vine.

North Pine river is crossed in section 36 of range 18. At low water this river is two hundred feet wide and about two feet deep, but at high water it is three hundred feet wide and more than eight feet deep with a current of four miles per hour. The valley is over six hundred feet in depth and averages one mile across. Sandstone of good quality was noted in the cut banks of this river.

Through ranges 18 and 19 the country is rolling and the timber is almost all poplar with willow scrub. A large prairie lies to the north of the line and much of the country south as far as Peace river is scrubby prairie.

Charlie lake, crossed in the western two miles of range 19, extends for about seven miles northwesterly and southeasterly. It is drained from the south by Fish creek which runs into North Pine river.

In range 20 the line passes through a belt of good heavy spruce with a few strips of poplar, many of the trees being three feet in diameter and perfectly sound. With the exception of a few small areas of poplar and jackpine this belt extends about one mile south and eight miles north of the line. The timber moreover could be marketed without great expense as it could be rafted to Peace river via Charlie lake, Fish creek and North Pine river.

The country is hilly and well watered by fresh streams, while the soil is black loam and clay. From the hills west of Charlie lake one can see the mountains in the distance.

Through range 21 and the east half of range 22 the country is still hilly but the timber is poplar and scrub with an occasional small belt of spruce. The soil is clay and clay loam and the underlying rock appears to be limestone.

Through the middle of range 22 flows Cache creek while just beyond the west boundary of the range is its west branch. Between these two streams is a level stretch of country extending to the streams themselves while the country to the north is hilly. Part of the surface is prairie and the rest is covered with poplar.

The country through range 23 is rolling, the surface being covered with small brulé, spruce and tamarack swamps and small strips of jackpine and poplar. The soil near the line is very sandy but a good area of farming land lies about six miles to the north.

Halfway river flows southerly through the middle of section 31 in range 23, in a valley five hundred feet in depth and varying from a half mile to a mile in width. At low water the stream is about three hundred feet wide and four feet deep with a current of five miles per hour, but in some places the river narrows to straight rock walls with a very swift current while in others it has wide gravel bars strewn with driftwood and even whole trees. At high water it is over a quarter of a mile wide in places and at least ten feet deep in midstream.

From the valley of the river to the west boundary of the block the country is mostly undulating and the surface is covered with jackpine, spruce, poplar, willow, alder, and spruce and tamarack swamps while the creeks are few until nearing the west boundary. About six miles south of the line in range 24 there is an area of about forty square miles of good farming land in which the soil is clay and clay loam.

About one mile south of the line in the middle of range 24 and turning abruptly south into Peace river a stream about forty feet wide and one foot deep flows through a valley three-quarters of a mile across and nearly three hundred feet in depth.

Grayling are found in North Pine river, grayling, speckled trout and pike in Halfway river, and rainbow trout in the stream running through range 24. In the spring ducks, geese, partridges and prairie-chickens are plentiful, while rabbits are numerous at all times. Black bears and moose are seen occasionally. Most of the fur-bearing animals and large game, however, are exterminated, so that the Indians now go north nearly to Fort Nelson river for their winter's hunt.

Potatoes, carrots, beets, cabbage, parsnips and lettuce of excellent quality are raised at Fort St. John, and one settler there states that in addition to the above he has ripened tomatoes, rhubarb, squash and on one occasion watermelons. Wheat has never been tried here, but we were informed that as a general rule there is ni serious frost in the valley before October, although along the line frost was noted on July 13, 20, 21 and 23, and on August 8.

Fort St. John is situated on the north side of Peace river about five miles above the mouth of Pine river. The Hudson's Bay company, and Revillon Bros., each have a post here, and the British Columbia agent has his office on the south side of the river. The Hudson Bay company's steamer makes three trips a year between St. John and Fort Vermillion.

We commenced our return trip on October 16 arriving at Fort St. John on the 23rd.

While crossing Halfway river one of our men was accidentally drowned and although the party searched for two days no trace of his body could be found.

The pack-trail from St. John to Tremblay's ranch on Pouce Coupé prairie is good, the country being well watered and feed excellent. As well as one can judge from travelling a pack-trail this prairie will make good farm land, and when Grande Prairie district is settled this appears to be the natural direction for newcomers to move and make their homes. A wagon road to Fort St. John can be built with but little work except at the crossing of Little Kiskatinaw and Pine rivers.

APPENDIX No. 44.

ABSTRACT OF THE REPORT OF A. SAINT CYR, D.L.S.

SURVEY OF PART OF THE SEVENTEENTH BASE LINE FROM BEAVER RIVER WEST TO THE FOURTH MERIDIAN.

Before continuing the production of the seventeenth base line from the point where we ceased operations in the fall of 1910, I proceeded to township 57 on the third meridian and from the point where the road to Montreal lake crosses the meridian in section 13 I made a traverse survey of the lake, in order that its position might be shown correctly on the maps.

Having completed this work I returned to Prince Albert, and on March 22, 1911, set out for the initial point of my survey of the base line, west of Beaver river.

I followed the winter road from Green Lake to Cowan river and then travelled over the ice on this stream and Beaver river to Rat creek, where the winter road ascends to the top of the benches rising west of Beaver river.

In that distance there are some rapids and I had been informed that the ice had already given way in places. It was feared that, if the mild weather with which we had lately been favoured, continued, the water would rise in Cowan river breaking the thin ice over the rapids and making it difficult for us to reach the base line.

As it was urgent that all our outfit, supplies and a large amount of horse feed should be brought west of Beaver river before the general break up came, I hired additional help at Green Lake settlement.

On March 31, having finished all my business at Green Lake, and after making arrangements to have mail brought to my camp at intervals during the season, I left for the seventeenth base line.

The road we followed in returning to the base line is part of the road travelled in the winter by the mail carrier and also the freighters going to the settlements and the fur-trading posts at Lac la Plonge and Ile a la Crosse. It is a long and circuitous route and has, besides, serious drawbacks.

Two years ago companies were formed to develop the fish industry in the northern part of this province and the winter traffic created by this new industry which must pass over this road, added to the transportation of the large amount of goods required by the fur-trading companies in provisioning their posts and the northern settlements, has led all the parties whose trade interests call them into this northern country to seriously consider the advisability of continuing northwards beyond Doré lake the new road opened last winter to this place.

It would give a continuous overland route which they claim would also be much shorter than the one followed at present.

My transport outfit consisted of ten flat sleds which had been made broader than usual in this country. These can be used to advantage over fairly level country or on well beaten roads, when a pony will haul loads averaging five hundred pounds. For the transportation of the horse feed and the baggage of the party, I took the double sleds which I had used on my two previous winter surveys. On March 31 the survey of the seventeenth base line was resumed at the northeast corner of section 35, township 61, range 13, west of the third meridian.

It progressed rapidly across ranges 13, 14, 15 and 16, where many large open swamps are intersected by the line. Being still frozen they afford the best route for moving the outfit between camps, and on the lakes the ice remained firm enough to carry teams till the end of April, or long after the snow had disappeared. By that

time we had come to the high land north of Waterhen lake. The only obstacle met with, west of Beaver river, was the crossing of Waterhen river, near range 15; here large rafts were built and were used for ferrying our outfit.

The ponies also had to be transported on these rafts to the opposite side of the river as the water was not deep enough to allow them to swim and the bottom is too soft and treacherous to risk taking horses across this stream, which for several miles on both sides of the base line is quite wide. During the summer the survey went on without interruption, the country gradually improving for travelling as we moved westward. By July 24 the line had been completed to the east shore of Cold lake in section 32, township 64, range 25.

From the northeast corner of this section a tie was made on the fourth meridian north of Cold lake by surveying the east boundaries of sections 5, 8, 18, 19, and the north boundaries of sections 8 and 19 in township 65, range 26. Thence the line was produced across fractional township 65, range 27, to the fourth meridian, where it struck two chains and thirty-two links south of the northeast corner of section 24, range 1.

On August 9 the survey of the seventeenth base line and the levels along this line had all been completed to the fourth meridian.

DESCRIPTION OF THE COUNTRY ADJOINING THE SEVENTEENTH BASE LINE, FROM RANGE THIRTEEN TO THE FOURTH MERIDIAN.

West of Beaver river which, from its confluence with the outlet of Green lake, flows across range 12, is a strip of nearly level country with many open swamps, a few of which, when drained, could be converted into profitable hay meadows.

The soil on the higher lands, which are at present wooded with poplar and birch, is good. At intervals are found ridges where jackpine grows. These ridges are more frequently met in the southern half of township 64 in the vicinity of Beatty creek, a small tributary to Beaver river, which it joins seven miles south of the base line.

Travelling westward across ranges 13 and 14, several large lakes are passed, which drain into Waterhen river, four miles north of the base line. This stream leaves Waterhen lake near the northeast corner of township 63, range 16, and flows northeasterly to the east outline of range 14, thence its course is due east for seven miles where it joins Beaver river.

Many rapids are encountered on Waterhen river in that distance of twenty-five miles, and though the Indians who ascend this stream in canoes have made artificial channels by removing the worst obstacles, they sometimes upset their loads in going through these intricate places.

Waterhen river is 100 yards wide, in its widest part, and at seventeen miles from its mouth receives a large creek which comes from the north through range 15. The Indians report that they can ascend this stream in their canoes a distance of eighteen or twenty miles.

This stream is intersected by the line three quarters of a mile from its mouth. Along it the country is fairly open and although the land is stony in many places the soil is good and wild hay, pea-vine and vetch grow on the prairie patches found at intervals in the valley.

The aspect of the valley of Waterhen river varies greatly. It is widest for four miles below Waterhen lake but, farther down, the benches at intervals approach to the river banks, their steep slopes reaching down to the water's edge.

In such places there are rapids separated by stretches of comparatively slack water confined by low swampy meadow lands. Similar meadow lands are found also near the mouth of Waterhen river, and extending back three or four miles to the first rapids. The wild hay which grows in this vicinity is of good quality and is found partly on the flats along each bank of the river, but mostly on certain islands, for, a short distance below the last rapids, the river divides into many channels

A larger quantity of good hay could be cut here by the Indians if the land was cleared of the clumps of willow dispersed all over these flats. Even instead of using the primitive way of cutting hay with scythes as is their custom, light mowing machines such as are used around the settlements of Green Lake, Island Hill and Meadow Lake could be used to advantage.

At about eight miles up stream from Archibald's crossing-place more hay meadows are reported to exist. Before reaching these, however, the valley narrows, while from the right bank of the river rises a range of round knolls across which run, through narrow gorges, the drainage of the lakes and wet swamps found west of Beaver river.

As the fall is considerable between Waterhen river and the wet lands, these could easily be drained.

Between the crossing of the river by the line near the northeast corner of township 54, range 15, and Waterhen lake, a few narrow meadows adjoin both banks of the river. At one or two places on the north side, when approaching the old Indian village, these meadows extend inland from a quarter to one mile back from the river, to the foot of the high wooded hills.

At the site of the old Indian village the hills recede from the river and the intervening country is not so broken. It has, moreover, been to a large extent cleared of the heavy timber by repeated fires which have overrun it.

Of this spruce forest there now remains only a block of three square miles which is crossed by the line in sections 35 and 36, range 16. The trees are from ten to thirty-six inches in diameter. Two miles north of this block of timber are lakes, the largest of which covers nearly all of sections 14 and 23 in township 65.

The rolling country to the east is wooded with poplar, birch and scattered spruce. More lakes are found to the northeast where the country becomes low and swampy and where I came to impassable quaking bogs which probably drain into the largest tributary of Waterhen river.

A similar low country is also reported to exist in the west half of township 65, range 15, and to extend far towards the seventeenth correction line.

East of Waterhen lake the country is hilly. Poplar bush extends to the middle of range 15, where low and sometimes very boggy lands lead to a lake lying in the northeastern part of township 63. This low country surrounds the lake to the south and continues far to the east where most of its drainage goes to the Beaver by way of Beatty creek. Many small lakes surrounded by hay meadows are reported along the course of this creek.

A large stream flows out from the east side of the lake in township 63, and turning northwards runs along the foot of pine wooded hills which rise a short distance from the northernmost bay of this lake. It eventually connects with another large lake in section 33, township 64.

The Hudsons' Bay company's trading post at Waterhen lake is built on the east side, on an arm of the lake, which separates it from the Indian village. Across these narrows there is hard bottom and as the water is not over two feet and a half deep in ordinary seasons, the Indians frequently ford this with their ponies.

This trading post is the end of the winter road to Green Lake, which crosses Beaver river a short distance from Island Hill. From the post this road passes through a rolling country wooded mostly with poplar and birch and extending three miles beyond the south shore of Waterhen lake. Thence to Beaver river, the route is over nearly level country with good soil where wild hay grows in profusion.

Two deep bays cut into the north shore of Waterhen lake and from the northeast bay Waterhen river flows. This bay is shallow and the mud banks are covered with tall grass and reeds which are frequented in the summer by countless flocks of the birds from which the lake derives its name. Their eggs are very delicious to eat and are much prized by the Indians on account of their not having the peculiar fishy flavour noticed in the eggs of some other kinds of aquatic birds.

Flotten river flows into the northwest bay which extends past the north boundary of township 63, range 17. It is a rapid stream which carries to Waterhen lake the waters of Flotten lake, a body of water seven miles long and three miles wide. The river being a succession of rapids, cannot very well be used in going from one lake to the other. There is, however, a good portage five miles long, which runs to the east side of the river up to the south end of Flotten lake and thence northwards through the country east of the lake.

The country on both sides of this river and lake has been visited by fires. The surface is quite hilly near the lower reach of the river but has a better appearance near the base line where it is more level, while patches of prairie land are often seen interspersed with poplar bluffs and clumps of spruce.

Some large spruce from ten to twenty-four inches was noticed along the north shore of Waterhen lake east of the mouth of Flotten river, which will cover tracts of from five to ten acres.

The rest of the country adjacent to and north of Waterhen lake is wooded with poplar four to ten inches in diameter. Birch also grows along the lake shore and on most of the hills, while large jackpine ten to twenty inches are also frequently seen.

Flotten lake covers the central part of township 65 and extends to its north boundary. East of the lake are three miles of dry and sparsely wooded land which borders on the large stretch of low country noted across range 16.

North of Flotten lake there is a strip of burnt-over country half a mile in width and north of this is twenty square miles of large spruce timber which it is estimated will yield 30,000,000 feet of lumber.

Two small creeks flow across this forest and discharge into the lake. Two trails lead to this block of timber, one of which starts from the northwest bay of Waterhen lake and goes to the east edge of the heavy timber, and the other begins at the north shore of Flotten lake, going three miles north through heavy timber, then turning northeast and probably joining the other trail.

From range 18 to range 24 the base line passes over a succession of high hills and crosses some wide deep valleys. These valleys lead to a depression which extends west from Waterhen lake to the fourth meridian.

In that depression lie lac des Isles and Pierce lake, which, with their connecting rivers, form a continuous water route between Cold and Waterhen lakes.

Of the many valleys crossed by the line in that distance of forty miles two deserve mention, because through them access may be had to the northern country which otherwise is difficult to reach owing to the large quantities of windfall.

In each of these valleys are well-defined trails indicating that they are frequented by the Indians on their hunting trips. Good pasture is also found along the creeks which wind through these valleys.

The first valley was intersected by our survey in the west half of range 19. Three miles south of the line in the valley there is two hundred acres of large spruce, while smaller areas are reported at intervals farther south. The other valley follows the east outline of range 23, and about midway between the valleys in section 32, range 21, occurs the highest elevation met with on our survey. Both valleys where the line crosses are very deep and are about half a mile wide between the crests of the benches. Towards the south the valleys become gradually wider while their benches get considerably lower.

Very little timber suitable for lumbering is now found in these valleys, the sides of which are wooded mostly with poplar.

The streams which flow in these valleys are fed by numerous springs rising in the hillsides, the water being strongly impregnated with iron. The whole country is covered with second-growth poplar, birch and pine, while the soil consists of clay loam sometimes mixed with gravel and stones. This country is too rough for farming but when cleared of the light woods and scrub which grow in places, it would be

suitable for stock-raising. Grass grows everywhere through the light poplar woods and on the hillsides. Such is the general character of this elevated land.

Through ranges 24 and 25 the land is undulating and not so stony in the vicinity of the line, though a few miles north of the line the country again becomes rough. The hills are covered with deadfall and there are large tracts wooded with jackpine which has been killed by a fire which must have occurred very recently as the dried leaves are still on the trees.

The soil consists of sandy loam six inches deep with a subsoil of clay.

In section 34, township 64, range 24, is a lake surrounded by hay lands north of which, in section 4, grow some large spruce. The line cuts through the south limit of this clump of timber and then through three miles and a half of swampy land.

In section 35, range 25, we crossed an Indian trail in the valley of a creek which flows into Pierce lake, four miles to the south. West of this stream is a strip of large green poplar and beyond this again is a stretch of several miles of fire-killed timber and windfall.

In the summer of 1910 a disastrous fire swept over these dense forest lands. It appears to have closely followed the pine woods which always contain masses of inflammable material, but to have hardly penetrated the poplar woods. The fire appeared to have started about three miles south of the base line in range 25 and fanned by the high winds to have spread in a generally northwesterly direction to the valley of Primrose river. There its progress does not seem to have been checked to any extent, as recently burnt-over areas were seen west of that stream. These forest fires are hard to account for. Indians seldom visit the country and they always carefully put out their camp fires, even going to the trouble of banking them with clay. These Indians seem to understand pretty well too that it is in their interest to preserve the forests which are the haunts of game on which they mostly subsist. After each fire moose and deer will leave the country and will not return for several years. I believe that some of the forest fires are caused by lightning, for, many times after an electrical storm which is always followed by high winds, I have noticed clouds of smoke rising from sections of the country where we had not previously noticed any indications of fire.

From range 26 to the fourth meridian the land is rolling and densely wooded with second-growth poplar, birch and balm of Gilead.

At one mile and a half west of the corner of township 64, range 26, the line runs through heavy timber, mostly spruce, covering two square miles. It is estimated that this timber will yield 1,500,000 feet of lumber. Large jackpine from eight to fifteen inches, suitable for railway ties, is found in quantities at many places and spruce from eight to twelve inches is scattered over all the country west of range 25.

The base line ends in section 32, range 26, at the east shore of Cold lake, a large body of water covering about 140 square miles, but in order to check our work the survey was continued around the north shore of the lake up to the meridian.

Wooded ridges generally surround the east side of the lake and I noticed at several places bold sandy bluffs along its shore.

The east shore of Cold lake, near the end of the base line, forms a deep bay, and from there is its outlet, a wide and rapid stream containing several islands, which we forded a short distance from the bay. The bottom is gravel and stones, and its crossing is safe at all times during the summer. This stream runs southeast to Pierce lake, five miles distant. The level of Pierce lake being 110 feet lower than that of Cold lake explains sufficiently the rapids on this stream.

Owing probably to the risk of upsetting their canoes in the rapids, the Indians make use of a portage over the hills between the two lakes.

Pierce lake is about eight miles long and four wide. It lies mostly in townships 63 and 64, range 25. Its outlet is at the east end of the lake and forms by its expansions two smaller lakes before it joins lac des Isles, six miles farther east.

The last mentioned lake is about eight miles south of the base line and extends across ranges 22 and 23. Where Waterhen river enters lac des Isles the Hudson's Bay company has established a fur-trading post, which is connected by a wagon road to their other post situated north of Waterhen river, and close to the east end of this lake.

One of the roads from Onion Lake settlement comes to the trading post at Pierce lake, so that access to this district is possible at all times.

South of Pierce lake are miles of hay land and a Cree settlement has sprung up in the neighbourhood. All these people own horses and wagons, but none of them appear to have attempted any cultivation of the soil although it is very good. They are satisfied with putting up hay at which occupation they were all busy when we passed at the end of August.

Besides the wagon roads which follow the more open sections there are many pack-trails winding across the woods.

From Sandy bay along the south shore of Pierce lake a pack-trail leads to section 12, township 63, range 1, west of the fourth meridian, passing within half a mile of Cold lake.

We followed this trail when returning to the meridian to complete the levels along that line; it was necessary to widen it somewhat to allow our loaded pack-horses to pass through the woods.

After crossing the hills near Pierce lake this road turns southwesterly towards a more level country which is covered with poplar bluffs alternating with patches of willow scrub near the lakes and hay marshes.

At Cree lake, which is five or six miles east of the meridian, we came to a belt of fine spruce trees up to thirty-six inches. They grow in thick clumps near the lake, but are more scattered, though still of large size, as one approaches the meridian.

The timber begins in the northwest quarter of township 63, range 26, and extends southwest across range 27. There were indications of a recent fire having been started in the vicinity of Cree lake which is frequented by the Indians, but after skirting the west edge of the forest this fire luckily died out within a short distance of the best timber.

Growing among the spruce are poplar from ten to fifteen inches and cottonwood ten to twenty-four inches. Through the woods of this country there is a heavy undergrowth of hazel and other low bushes.

The Cold lake district offers real advantages for mixed farming. Some sections in the surveyed part were taken up a few years ago and the homesteaders have proved the fertility of the soil for growing cereals and all kinds of ordinary vegetables.

There is also plenty of upland hay which is always mixed with large quantities of pea-vine. Wild hay of good quality is also found in the lower land near lakes and ponds and all the creeks contain fresh water.

Last summer many prospective settlers brought their families with the intention of taking up sections of the still unoccupied surveyed lands southwest of Cold lake.

This district is far from being isolated, as some of the roads lead south to the older settlements, while others reach St. Paul-de-Metis and Vegreville.

There is a general store and a post-office near Beaver river which is crossed by ferry.

From Cold Lake post-office in section 15, township 62, range 2, a new road leads in the direction of the Cree settlement, fifteen miles east of the meridian. We came out that way and in order to avoid a long detour we corduroyed this road where it crosses a neck between some hay marshes which spread for a considerable distance north and south. This road has never been properly cleared of brush and till recently was used as a sled road, but it could be improved at a small cost.

CLIMATE.

During the spring and until the end of June we enjoyed dry, fair weather which had also the effect of subduing to a noticeable extent the mosquitoes and kindred

pests, but in July and the first part of August hardly a day passed without heavy showers, often accompanied by hail-storms. August and September proved to be ideal months for our work. The summer was appreciably cooler than in Prince Albert, and summer frosts were experienced in the months of July and August, the ice in some cases being a quarter of an inch thick on the water in the tent.

Large game, still plentiful in this country, consists of deer and moose, whose well-beaten paths cross the land in all directions. Bears and the smaller fur-bearing animals, such as mink, marten and weasels, also were met. Of the feathered game ruffed grouse, prairie-chickens, swamp partridges, &c., are quite common in some localities, while ducks and other aquatic birds are seen all summer. Such birds as the pelican and the loon, which are seldom seen near the settlements, remain all summer on the lakes in the northern country.

There is a large supply of various species of fish in all the larger lakes and streams. They consist of pike, pickerel and carp. Trout and whitefish with the above-mentioned varieties are caught all summer in Cold lake but in all such lakes as Pierce lake, lac des Isles and Waterhen lake they are caught during the winter only. Berries such as cranberries, saskatoon berries, wild cherries, strawberries and raspberries are plentiful, and also another luscious kind which grows in all muskegs.

Although no minerals of economic value were discovered in the district adjacent to the base line, there are some localities where bog iron must exist, as proved by the abnormal deviations of the magnetic needle recorded at such places.

APPENDIX No. 45.

ABSTRACT OF THE REPORT OF W. A. SCOTT, D.L.S.

MISCELLANEOUS RESURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

My first work consisted of the retracement of townships 7 and 8, range 6, and township 8, range 7, west of the fifth meridian. The country in this vicinity is fairly well settled and is rapidly becoming fenced up. The trails followed at present are chiefly old trails, but in a few years the road allowances will be the only means of travel.

This part, and in fact the whole country from the main line of the Canadian Pacific railway south to the international boundary, was devoted chiefly to the raising of horses, but in the last few years as the homestead lands in the West have been rapidly taken up, this part has been filling up with settlers, until now ranching to any large extent has ceased.

The surface is rolling prairie of which only a very small part, the deep coulees of the small creeks, cannot be brought under cultivation. The greater number of these creeks are dry for the most of the year and only those of considerable size continue to run during the summer. The rainfall is light, the greater part of the moisture being precipitated during the months of May, June and July, and the climate may be said to be dry. The question of water supply is one of paramount importance and will eventually be solved by irrigation or dry farming.

The nearest railway at present is the Crowsnest branch of the Canadian Pacific railway, there being no other railway between this and the international boundary. This means that some of the settlers have a haul of sixty or seventy miles.

There seems to be a large number of small mines in this vicinity where lignite is mined in small quantities to supply a local market.

The next work was the survey of coal lands in townships 9, 10, 11, 12 and 13, ranges 4 and 5, west of the fifth meridian. The best route for reaching these townships is by leaving the Crowsnest branch of the Canadian Pacific railway at either Cowley or Lundbreck and following a fairly good wagon road to the 'Gap' which is the pass of Livingstone river through the Livingstone range. The road as far as the 'Gap' is fairly good, but beyond that it is merely a trail. Wagons may be used up Racehorse creek a distance of four miles, then up Livingstone river to the fourth base line and up the northwest branch as far as section 9, township 12, range 4, where there is a building, once used by the Great West Coal company, but now deserted. There are good pack-trails following the courses of all the large creeks. These pack-trails have been improved to a very great extent by the fire rangers located in this district during the past season, and I believe more improvements along this line will be carried on during the ensuing years.

The Livingstone range follows a course almost due north and distant about two miles from the east boundary of range 4. Between the Livingstone range and the range of mountains defining the boundary between Alberta and British Columbia the country is of a mountainous nature but there are no distinct mountain ranges. There are many hills as high as the Livingstone range itself, but they are almost all wooded except the tops which are bare rugged rocks. There is scarcely any timber of any commercial value east of the east boundary of range 5, but from there west to the boundary of Alberta there is a great deal of jackpine from twelve to thirty inches in diameter.

The greater part of townships 9, 10, 11 and 12, range 4, was burned over in July, 1910, and most of the timber was destroyed. However, in some places where the fire

burned at night or during a day with little or no wind, it was confined chiefly to the ground and underbrush and the trees were not killed. This was the case to a greater extent in the northerly townships than in the southerly part as there was more windfall in the latter.

The hills abound in coal of a very good quality. On almost every hilltop could be seen an exposure of a coal seam and sometimes several seams. The dip of the rocks is to the west and varies from 30 to 60 degrees, while the strike is almost due north. This formation gives an easy slope from the west ending abruptly at the hilltop in a precipitous rock face towards the east. The coal formation as a rule lies immediately below a conglomerate formation which is readily distinguished from the other formations.

All the streams have a good fall and are very rapid, and water-power could be developed on almost any of them, for although the flow of water would be comparatively small, there is almost no limit to the head that could be secured.

The streams teem with trout and many tourists take advantage of this sport. There are also a few deer and bears and there are mountain sheep and goats in the more rugged parts. There is an ever increasing number of sportsmen visiting this country and they are pushing farther and farther back into the mountains as the trails are opened.

The season for survey work in these mountains is rather short as it is not profitable to commence work west of the Livingstone range before June and operations have to be closed some time in November. There was so much snow in November of the past season that the party was withdrawn and paid off on the 16th.

During the remainder of the season a number of miscellaneous surveys were performed in Alberta and Saskatchewan, including work in townships 32 and 33, range 10, township 32, range 11, and township 26, range 15, west of the third meridian, and township 41, range 13, townships 45 and 46, range 16, township 45, range 17, and township 60, range 25, west of the fourth meridian.

APPENDIX No. 46.

ABSTRACT OF THE REPORT OF P. B. STREET, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA, SASKATCHEWAN AND ALBERTA.

The party was organized for the season at Lethbridge and having made all the necessary arrangements we left there on May 10 for Milk River where we arrived the following day. The district from Lethbridge to Stirling is mostly undulating prairie, with a rich clay loam soil. Under the irrigation system good crops are grown, and the majority of the farms are wholly cultivated. South of Stirling the country is more rolling, but the soil is uniformly good, and the crops are usually heavy. Here we saw irrigation ditches entirely filled with dirt which had drifted in during a heavy windstorm on the previous Saturday. The whole district is settled by Mormons.

We commenced the retracement of township 2, range 13, west of the fourth meridian on May 14, and completed it on June 1. Milk river flows easterly through the southern part of this township and is the chief source of water supply for the settlers. The soil is mostly sandy loam and is better suited for mixed farming than grain growing. The whole township is settled but only about twenty per cent of the land was under cultivation last season.

Our next work was a restoration and retracement survey of township 2, range 12, which was completed on June 15. Part of this township is under lease to the Deer Creek Cattle company, but the remainder is all settled. The soil is sandy loam and considerable stone and gravel is found in places. The constant hot winds in this district dry up and scorch the vegetation early in the summer and there are many years when a wheat crop cannot be raised. Mixed farming, would, however, prove successful.

On June 16, we commenced the retracement of township 2, range 14, but our progress was greatly impeded by the inaccessible banks of Milk river, the trails which formerly led to the fords having been fenced up by the settlers. The soil in this township is clay loam and holds the moisture much better than in townships 2, ranges 12 and 13, and I would judge that dry farming would be successful.

Having completed the work here, we left on June 30, for the Crowsnest pass which we reached on July 10. The country through which we passed on this trip looked very prosperous, and the grain, although a little backward at that time of the year, looked very healthy and promised a fine yield. Around Raymond a great many sugar beets are grown for the Knight Sugar company which is located there. Small fruits are also grown successfully in this district, and some settlers have recently planted fruit trees which may prove a successful venture.

West of Cardston one cannot help noticing the decided improvement in the vegetation over that in the vicinity of Milk River. There is a great deal of cultivated land west of Belly river, although most of the old ranchers have kept a portion of their holdings for pasture. The settlers in the Pincher Creek district are turning to mixed farming and stock-raising, as the last two years have proven that in this district wheat crops cannot be depended upon, on account of the early frosts which occur owing to the high altitude.

At Crowsnest business was very quiet, as, owing to the coal strike, many miners had left the district temporarily.

Our work here, in township 8, range 5, west of the fifth meridian, consisted in extending subdivision lines across Sentinel and Summit mountains and traversing a

portion of Island lake. Here we lost a few days owing to the clouds descending to an altitude of 6,000 feet which was below the level of our work in the mountains. No indications of coal were seen in this township, as the rocks are mostly of limestone formation. Limestone is quarried and burned in section 7.

Our next work was in township 5, range 4, and consisted of the extension of subdivision lines to include certain coal lands. For this work, owing to the mountainous nature of the country, frequent flying camps were necessary. The northwest quarter of this township contains some rather poor timber, but the remainder contains an unusual amount of first-class timber. Spruce from twelve to forty-two inches is found in large quantities as well as some good jackpine, but very little fir was seen, as the altitude was too great.

The coal seams of the Premier Coal company have some remarkable showings, and the seams can be traced across country for miles. It is an excellent coking coal and burns very clean.

Our work in township 5 was at an altitude of from 6,000 to 7,000 feet, and here as at Crownest, we were delayed by cloudy weather. On September 5 snow fell to the depth of one foot and there were several snowfalls more before the end of the month.

From here we moved to township 4, range 1, where we traversed Fisk lake. This township, as well as several townships south and east, is well adapted for ranching, as there is an abundance of feed, water and shelter. The present settlers, however, seem to prefer farming, and a great deal of baled hay is annually shipped from this district.

After doing some retracement work in township 7, range 30, west of the fourth meridian, we left for Milk River to retrace township 2, range, 15, which we reached on November 3.

The weather turned very cold on the 7th, the temperature falling to —20°, and a strong wind blowing made a regular blizzard till the 10th.

We finished the retracement of this township on November 21, and on the following day I paid off the party retaining only one assistant.

During the remainder of the season I and my assistant removed some duplicate monuments in township 9, range 21, west of the second meridian, traversed Icelandic river in township 23, range 3, east of the principal meridian, retraced some lines in township 21, range 4, and investigated the marking of a witness post in township 23, range 6, both west of the principal meridian. Having finished this work, I paid off my assistant at Winnipeg and left for Toronto, where I arrived on December 29.

APPENDIX No. 47

ABSTRACT OF THE REPORT OF C. H. TAGGART, D.L.S.

SURVEYS IN THE RAILWAY BELT, BRITISH COLUMBIA, IN THE VICINITY OF KAMLOOPS.

My first work was establishing the north limit of the Monte Hills forest reserve. The route to this work was along the road from Kamloops to 'grand prairie' for twelve miles. From there a branch road to Campbell lake was followed, and then a rough wagon road to Wolf lake. From there to where the north boundary of the reserve crosses the summit of the hills, there being no road, a pack-trail had to be cut out.

The surface of the country along this boundary is very rough and is densely wooded with jackpine from three to fifteen inches in diameter, and scattered spruce up to forty inches. The soil is a sandy loam with gravel subsoil, and in some places the rock is found close to the surface, while in others it is solid rock outcrops.

The south limit of the railway belt in townships 16, ranges 15 and 16, was our next work. To reach this we had to return over our old route to Campbell lake, and then proceed via Barnhartvale and Napier lake. The road between these two places follows a narrow valley the bottom lands of which produce hay and alfalfa in large quantities, and while cattle-raising was formerly the chief industry, fruit growing is now obtaining prominence. At the foot of Trapp lake a large portion of land is being divided into fruit farms of ten and twenty acres each and an extensive irrigation system is to be installed.

In townships 16, ranges 16 and 17, some good grazing land was noticed, but easterly from section 21 in range 16, the country becomes rough and rocky, and difficulty was experienced in getting a road for the pack-horses. As our next work lay in township 17, range 13, we cut out a pack-trail to the wagon road along Salmon river. The district around 'grand prairie' in this township is being subdivided into fruit farms, and the water of Salmon river is to be used for irrigation purposes.

We next proceeded to timber berth No. 550 on Kingfisher creek, in township 20, range 6, which was our next work. A good wagon road took us as far as Enderby on the Okanagan branch of the Canadian Pacific railway. From Enderby to the mouth of Kingfisher creek the road was rough and from there on we were forced to follow the creek bed through water waist deep and very swift.

The survey of timber berth No. 545 in township 23, range 18, west of the fifth meridian was our next work, and having completed this on August 17 we began subdivision in section 12, township 24, range 19. In this valley, from Golden south to the limit of the railway belt, there is a rich agricultural district, but the best land is included in timber berths, and although the timber is cut off very little improvement has been made as titles cannot be obtained by the squatters, some of whom have lived there for ten years. Wherever development has taken place the results obtained have been excellent, especially with the small varieties of fruit. The bench lands as well as the bottom-lands are being taken up, and though the former may require irrigating an abundant supply of water is available from the mountain streams. Good roads lead through the valley and steamers ply on the river.

We completed the work in this valley on September 30 and left for Revelstoke to perform some surveys in township 23, range 2, west of the sixth meridian. This was completed on October 26, and from then until November 28, we were engaged in traversing the right bank of Columbia river in township 22, range 2, and township 21, range 1, retracing section lines in the same townships and also performing a

small amount of traverse in township 21, range 1, west of the sixth meridian, and in township 21, range 29, west of the fifth meridian. During the progress of this work we experienced a three days' blizzard followed by a three days' sleet and rain-storm which greatly retarded our progress.

The lower Columbia valley south of Revelstoke averages about one and a half miles in width. It is mostly covered with a dense growth of under brush and is timbered with cedar from four to twelve feet in diameter. Some hemlock of good size was also noticed but cedar is the chief asset. The soil is mostly a sandy loam with gravelly subsoil, and so porous that irrigation is necessary. Fruit growing here is only in the experimental stage yet, but good crops of vegetables grow wherever the land has been developed, and a convenient and ready market is found in Revelstoke.

The work in the vicinity of Revelstoke being finished we moved to Kamloops to survey the south limit of the railway belt westerly from the southeast corner of section 25, township 17, range 16, west of the sixth meridian, and also to perform some retracement and resurvey in the same district.

From here we moved to Trout lake in township 17, range 19, west of the sixth meridian, to make a traverse of the lake, establish section corners and lay out building lots for summer cottages. This lake is in the centre of the Long Lake forest reserve, twenty-one miles from Kamloops, and is accessible by a wagon and automobile road. It is the only convenient summer resort for Kamloops, and being twenty-nine hundred feet higher than the city the air is always fresh even in the hottest weather.

Our last work was the survey of a parcel of land in township 22, range 17, west of the sixth meridian, in the valley of North Thompson river. The Canadian Northern railway company are making rapid progress with the construction of their line on the east side of the river, and it is expected that this portion of the road will be in operation within two years.

APPENDIX No. 48.

ABSTRACT OF THE REPORT OF C. M. WALKER, D.L.S.

MISCELLANEOUS SURVEYS IN SOUTHWESTERN ALBERTA

We left Calgary on May 9 for township 21, range 7, west of the fifth meridian, where our first work of the season was located. The eastern boundary of this township for the first four miles, follows along the steep sidehill of a high mountainous ridge which, previous to the fires of 1910, was covered with a fair growth of spruce and jackpine from six to fifteen inches in diameter; now, however, this ridge, as well as the greater part of the township, presents a very desolate appearance, consisting only of barren rock slides and brulé with here and there a clump of dead spruce or jackpine.

Elbow river flows northward at a distance of from thirty to eighty chains to the west of the east boundary of this township, until near the northeast corner of section 24 where it flows east into township 21, range 6. Its width varies from seventy-five to three hundred links, and it has a uniform, though rapid fall, although no rapids of any account occur along this part of it course. The river-flat, consisting of gravel bars, has a breadth of five to forty chains in range 6, and this would prove an ideal storage basin for power purposes, as there is an excellent location for a dam in section 8, township 22. That such a storage basin is necessary to develop power is evidenced by the fact that on May 27 there was no flow of water in the main stream of Elbow river above Fisher branch, and three days later, when the snow began to melt, our horses were swept off their feet and carried about fifty yards down stream while fording this same river. A rise of two feet in the stream in six hours is not an unusual occurrence.

Our next work was the survey of the north and east boundaries of township 21, range 6. The east outline runs through country similar to that in the township to the west, though there is much less rock and the ridges are not so high. The surface, however, is rolling and cut by deep ravines. Threepoint creek canyon crosses the east boundary of section 1 in a northeasterly direction. It is four to five hundred feet deep and has loose broken shaly precipitous sides; there are, however, no indications of coal. A valley running northwest from Threepoint creek contains the only valuable land in this township. It includes section 11, the west halves of sections 14 and 34, sections 15, 22, 27, and the east halves of sections 28 and 33. The land in this valley is inclined to be boggy, but it could be very easily drained. It produces excellent hay, and, along with several small adjoining valleys, would make a good ranching district. The climate, however, would render farming out of the question as we had snowstorms or heavy frost every week throughout the whole season. No indications of minerals were found in this township, but game, consisting of deer and prairie-chickens appeared to be plentiful.

Having completed the work in township 21, range 6, we moved to township 22 to perform some subdivision surveys. The western third of this township and sections 28 and 33 are exceedingly rough, being composed of steep hillsides, bluffs and canyons from four to nine hundred feet deep. Some good spruce is found in section 6, and along Prairie creek in the northeast quarter of section 18, but elsewhere fires have destroyed all the merchantable timber. A redeeming feature of this part of the country is the remarkable number of outcroppings of lignite which occur in the vicinity of Canyon creek. As almost all of these outcroppings occur on approximately the

same level it would appear to indicate the presence of a seam or seams extending for some miles up the canyon.

Considerable development work has already been done. The southeastern portion is very rough with no standing timber of any account, and, though the surface consists of mountainous ridges, it shows no indications of minerals whatever.

A strip of level land extends along the south bank of Elbow river in sections 9, 10, 11, 15 and 16. It has excellent drainage facilities, and consists of good clay and sandy loam on a gravel subsoil, but summer frosts prevent the raising of even potatoes. Hay, however, grows in this flat, and also in a flat on the north side of the river in sections 24 and 25. Sulphur springs are located along the north branch of Canyon creek in sections 29 and 32, which give a strong taste and odor to the water.

Elbow river enters this township on the south boundary of section 4. The river flat varies from twelve chains to the bed itself and consists of gravel bars and boulders with here and there an occasional spruce. The rapids begin where the river enters section 5 and form a continuous series of cataracts to the centre of section 8, where an ideal location for a dam is formed by the high, rocky banks which are only eighty links apart at the river level. This dam could be used for either power or storage purposes.

The next rapids begin where the river enters section 16, and terminate at the falls, where there is an abrupt drop of about thirty feet, the entire volume of water passing between rock projections only forty links apart. From the falls to the mouth of Canyon creek in section 15 the river is a continual series of rapids, and in the canyon of the Elbow in the eastern part of section 15, the river has worn its way several hundred feet below the surface and runs through a rocky defile about one chain in width. A dam could be erected at the head of the canyon at little expense, as construction material is abundant.

After completing the traverse of this portion of Elbow river we resurveyed the east boundary of township 23, range 7, as far as the northeast corner of section 12, and produced the line by triangulation over Moose mountain, which is about eight thousand feet high. Immense gulches over one thousand feet deep and severe snowstorms greatly retarded our progress.

Many outcroppings of coal appear around Moose mountain, particularly in sections 4, 5, 8 and 9, in township 23, range 6. Several seams from four to twenty feet thick have been uncovered in section 8, and in the northeast quarter of the section a tunnel about one hundred and fifty feet in length has been driven into the hillside. The coal is said to be excellent for steam producing purposes.

The entire western portion of township 23 is very rough while the eastern part is more open and includes several hay meadows. There are no large streams and consequently no water-powers, but Little Jumpingpound and Bragg creeks have their sources there.

Our next work was a resurvey in townships 14, ranges 7 and 8, west of the principal meridian. Township 14, range 7, is very wet and covered with a dense growth of reeds and rushes eight to ten feet high. The southern tier of sections contains some tillable land but the remainder of the township is mostly under water. Delta, a small summer resort in section 14, is the terminus of a branch of the Canadian Northern railway. The shore of the lake at Delta is sandy and very shallow furnishing an ideal place for bathing.

Having traversed the lake across range 7 I performed some subdivision in range 8 and closed operations for the season on January 4, 1912.

APPENDIX No. 49.

ABSTRACT OF THE REPORT OF J. N. WALLACE, D.L.S.

LEVELLING NORTH FROM PRINCE ALBERT AND LLOYDMINSTER.

Our work for the season of 1911 consisted chiefly of the running of two lines of levels, one northerly from Prince Albert and the second northerly from Lloydminster. These were run to connect the levels along the meridians and base lines with railway elevations, these latter being, at present, the only available sources of information in the western provinces regarding sea-level.

A reference to the system of levels taken along base lines may serve to explain the necessity of these connections. The system of taking levels along base lines was inaugurated in 1908. In that year sixty-six miles were run along part of the eleventh base line west of the fifth meridian. During the seasons of 1909, 1910 and 1911 levels were run along more than eleven hundred miles of line, making a total of over two thousand four hundred miles of levels, all of this being along meridians or base lines The distribution of the mileage is as follows:—

Along the principal meridian and adjoining base lines two hundred and fifty miles, along the second meridian and base lines westerly seventy miles, along the third meridian and westerly two hundred and thirty miles along the fourth meridian and westerly five hundred and eighty miles, and along the fifth meridian and westerly six hundred and twenty miles. No levels have yet been run along the sixth meridian itself, but six hundred and thirty miles have been run on base lines to the west of it.

These levels, while not yet connected as a whole, are, as far as possible, connected in groups. Owing to the fact that levels were not taken in former years, and on account of the great expense it would cost to now reopen, for the purpose of taking levels, lines surveyed years ago, it is not possible to directly connect many of the new level lines. This difficulty, however, will rapidly disappear as time goes on, as levels are now taken along all base and meridian lines, thus keeping up a continuous connection. Each season's work will then be commenced with a known elevation, not on an assumed one, as at present, and the level records will be immediately available for use in themselves, and will afford comparison with other connected lines.

As regards the accuracy with which these lines have been run, the only checks available up to the present date have been the closing of two circuits, and the comparison between themselves of the two level lines always run along each base line or meridian during its survey. The circuits were composed of two neighbouring base lines with meridian lines as east and west boundaries. In the first case, the total length of circuit was three hundred and sixty-two miles, and the closing error 1·79 feet, which would correspond to a mean error of ± 0.005 feet per mile, or an accidental error of ± 0.09 feet per mile. In the second case the circuit was two hundred and four miles long and closed within 1·16 feet, the corresponding errors being ± 0.006, and ± 0.08 feet per mile. So far as the comparison of original and check levels on each line affords indication of accuracy, this difference may be considered as very seldom exceeding ± 0.05 feet over any one mile.

It is seen from this that the lines of the base line system are sufficiently accurate to make the present uncertainties of railway elevations in different parts of the West altogether greater than any accumulated errors which are likely to occur in the system and for this reason something better than railway elevations is necessary on which to base the elevations. The area over which the system extends is too great for a single

connection with one precise elevation, but several connections should be made, the most suitable points of connection being near the southerly end of each of the meridians. When a precise line of levels has been run along some railway extending east and west it will form a fundamental basis from which to run these connections northerly.

It was as a part of this general project of connecting the whole base line system, and in order to obtain reliable sea-level elevations at intervals that the two lines already referred to were undertaken. As already stated the first was from Prince Albert. It runs northerly along the Montreal lake road for thirty miles, to the intersection of the third meridian and the fourteenth base. The second a line of eighty-three miles long was run northerly from Lloydminster to the sixteenth base connecting with it a few miles east of the fourth meridian. In the first case the temporary datum used was that of the city of Prince Albert, which probably originated from the survey line of the Regina-Prince Albert railway many years ago. As regards the Lloydminster line, the datum used was that of the Canadian Northern railway. Both these data are more or less uncertain within a possible limit of as much as thirty feet, but in both cases absolutely no other datum was available for temporary use. Both these connecting lines of levels were run in the field by Mr. C. de la Condamine, D.L.S. He reports as follows:—

'I left Calgary on May 30, for Prince Albert to run a line of levels to connect the third meridian levels with an elevation in Prince Albert. I reached there next day and at once began to organize my party. As a preliminary I drove from Prince Albert to the northeast corner of township 52, range 1, to ascertain the best route to follow and to identify Mr. Saint Cyr's bench-marks on the meridian.

Actual levelling operations were commenced at Prince Albert on June 12 by connecting the rail level at the Canadian Northern railway station with a permanent bench-mark which I established on the post-office building, and with a bench-mark I found on the railway bridge over Saskatchewan river, which latter was subsequently found to have been established on an assumed datum, by the Public Works Department survey of this river.

The line of levels was then run northerly along the surveyed highway known as the Montreal lake road.

No difficulty of a serious nature was encountered, but the country being somewhat hilly in many places and the road not being cut out very wide where it runs through bush, many small delays occurred.

The total distance along the line of levels from Prince Albert to the southerly end of Mr. Saint Cyr's work is thirty miles. This work was completed on July 14.

The main object of the work was to connect the levels of the third meridian and neighbouring base lines to a railway datum, but in addition bench-marks were established along the whole route from Prince Albert. These consist of an iron section post, sunk in two feet of concrete under ground and appearing about six inches above the surface.

Three bench-marks were established at Prince Albert and seven others were placed between there and the north of township 52, at which latter point connection was made to Mr. Saint Cyr's bench-marks. The intermediate bench-marks were, as a rule, placed near the survey posts marking the angles of the road survey, reference distances being recorded to the survey post and the number of the post noted. The bench-mark is a round solid iron post flattened near the top and marked 'B.M.,' with a number following.

I found the general elevation on the third meridian at the north of township 52 to be two hundred and eighty-three feet above the rail level of the Canadian Northern railway at Prince Albert. Taking this latter as at an elevation of 1,393 feet above sea-level (which is not at all a certain elevation, but the best available at present) this would make the north of township 52 at a general elevation of some 1,676 feet above sea-level.

On completing this work I proceeded at once to Lloydminster in order to run a line of levels northerly from the railway there to give a datum for the levels along the fourth meridian and adjoining base lines.

I reached Lloydminster on July 15, and after establishing several bench-marks in the town and connecting them to rail level at the station, the line was run northerly, following in general close to the fourth meridian. From Lloydminster to Onion Lake the country is all prairie, but north of Onion Lake it is wooded and as the line of levels had to be run along the only available wagon road, which is very crooked, the full length of sight could not be taken except in a few cases.

Two routes could be followed from Lloydminster. One is a surveyed highway following near the meridian, generally good except that it has many steep gradients across townships 52 and 53. The other is a more generally travelled road which crosses Saskatchewan river at Hewitt landing. This latter is not so hilly as the graded road but it is longer and on the whole it was thought best, for purposes of easier recording of bench-marks, to keep along the graded road in the immediate vicinity of the meridian, and this was the route I followed.

The only difficulty encountered was the crossing of Saskatchewan river at the fourth meridian. The river is over one thousand one hundred feet wide and, when I crossed it I was unable to find any sand-bar on which to set up the level, or indeed any means of shortening the distance. I then proceeded as follows:

The instrument was adjusted carefully and the error of adjustment measured. Then a rodman crossed the river and established a temporary bench-mark on the south shore of the river. The rod was thirteen feet long and the stadia constant was 1/100. It was therefore possible to bring the three wires on the rod. After several trials the instrument was set up on the north shore at such an elevation that the middle wire came about at the middle of the rod. Then the second rodman established a temporary bench-mark near the instrument at such an elevation that the middle wire came near the middle of the rod. This was necessary to allow the north rod to be sighted on from the south shore. The three wires were read on the far rod and then on the near rod. The instrument was then shifted and the process was repeated three times, this giving nine readings on each rod. Results were compared at once and as they agreed satisfactorily it was thought a fourth setting was unnecessary. In order to correct the error of adjustment of the instrument I repeated the same process with the instrument set up on the south shore. The rods were interchanged, the one which was on the south shore being on the north one in the second operation.

Of course at such a distance it was impossible to read the hundredths of a foot; even the figures indicating the tenths could not be read but the tenths could be counted and the hundredths estimated.

In order to give some idea of the accuracy of this method I give below the values of the upper and lower intervals read on the far rod:

Intervals... ...	5·580 5·530	5·710 5·710	5·750 5·750	5·680 5·760	5·630 5·640	5·670 5·700
Difference...	0·050	0·000	0·000	0·080	0·010	0·030

The value of one division of the level was 10″ of arc. It was therefore possible to estimate about 3″. At a distance of one thousand one hundred and forty feet, this gives a possible error of about 0·02 of a foot. The maximum error due to this cause when reading an interval is therefore $\frac{1}{100}$ of a foot and the probable error 0·028. Two differences are beyond this value. Probably the largest error comes from the fact that the wires cover several hundredths of a foot and therefore the hundredths cannot be estimated with accuracy.

North of Onion Lake I followed the Ministikwan lake trail. This crosses the fifteenth base about four hundred feet east of the northeast corner of section 33,

range 26, and the sixteenth base about a quarter of a mile west of the northeast corner of section 33, range 25. Though rough it is a good wagon road and very few muskegs occur.

Connection was made on the fifteenth and sixteenth base lines to bench-marks already established during the survey of these two base lines.

From Lloydminster to Saskatchewan river one line of levels was run northerly and at the end of the season as a check, a second line was run southerly while north of Onion Lake the work was checked by a second line in sections about a mile long. This latter I consider much the better way. Camp need not be moved so often, and account can be kept of the way the work is proceeding, so that if any small errors are accumulating they can be at once detected, and means taken to avoid their continuance. Moreover, temporary bench-marks may become unreliable if the check levels are delayed for any length of time.

Permanent bench-marks, of the same nature as those left on the Prince Albert line, were left along the route from Lloydminster to Onion Lake, but north of Onion Lake, owing to lack of cement I had to use trees for bench-marks.

The country is undulating to within one mile of the north boundary of township 51, where the elevation is about one hundred feet below Lloydminster. From here northerly the land is hilly but still falling northward, the lowest elevation being in the southerly part of township 52, where the elevation is two hundred and twenty-five feet below Lloydminster. The ground then rises, attaining its highest elevation near the northeast corner of section 12, in township 53, where it is about one hundred and ten feet higher than Lloydminster. From here northerly the land falls again to Saskatchewan valley; the level of the water in August was four hundred and eighty feet below Lloydminster when I was going north and six feet lower when returning in October. The elevation of the rail at Lloydminster, according to the Canadian Northern railway, is 2,102 feet above sea-level. Using this as a temporary datum the elevation of the river would be 1,626 feet in August and 1,620 feet at the end of October.

Going north from Saskatchewan river the general elevation of the country steadily rises. About two miles north of the river its elevation is 1,820 feet. At Onion Lake, the ground in front of the English mission is 1,970 feet. The Hudson's Bay post being on a local hill is a good deal higher. Where the Ministikwan lake trail crosses the north of township 55, the elevation is 2,190 feet, or eighty-eight feet above Lloydminster.

From here there is a fall northerly to the valley of Beaver river. The water in Blackfoot lake is 1,989 feet and that of Mudie lake is 1,722 feet above sea-level.

Having made connection to bench-marks on the sixteenth base, I returned to Onion Lake and checked the whole line southerly from there to Lloydminster, where I ceased work on November 8.'

All the computations on the two lines run have been completed, and the corrections found to connect the data used during the survey of the several base lines with the elevations at Prince Albert and Lloydminster. These corrections give a temporary approximate sea-level datum for over eight hundred miles of levels already run which, while no more accurate than the best available datum at these two railway points, is yet much better than the previously entirely unknown conditions, under which the levels along base lines have had to be run in the past.

APPENDIX No. 50.

THE DETERMINATION OF THE MAGNETIC DECLINATION, DIP AND TOTAL FORCE IN WESTERN CANADA.

D. E. Chartrand, B.Sc.

Although the compass is not used in running lines on Dominion Land surveys, it is a valuable accessory especially in unexplored parts of the country. Where no line of definite bearing is available, it may be used advantageously as a finder of Polaris in daylight observations for azimuth. To accomplish this, however, a knowledge of the local magnetic declination is necessary; in other words one must know within a reasonable degree of accuracy the angular interval between magnetic north and astronomic north.

Historical sketch.

The accurate determination of the magnetic elements in western Canada dates as far back as the year 1842 when Lieutenant J. H. Lefroy, under the direction of the Royal Society, made a magnetic survey of that portion of the country. Magnetic observations were taken in the year 1887 by the Topographical Surveys Branch. Nothing further to any extent was done by this Branch until 1908 when Dominion Land surveyors employed by the Department were instructed to observe the magnetic declination during the course of their surveys.

An isogonic map, on a very small scale, was published in 1904, chiefly from data obtained from Lefroy's survey and the 187 observations of this Branch. Some information along the International boundary and around the Great Lakes was obtained from the United States Coast and Geodetic Survey. This map was intended only for the use of Dominion Land Surveyors employed by the Department.

In 1911 an isogonic map, on a very small scale, of that portion of Canada south of the 54th parallel of latitude was prepared and published in two sections, one for eastern Canada and the other for the western provinces. The declinations used for the western section were derived from the observations of this Branch. The sources of information for the compilation of the eastern section were: the Director of the Meteorological Service at Toronto, the British Admiralty charts, and the United States Coast and Geodetic Survey.

Area covered.

As the survey operations under this Branch are confined entirely to the lands under the control of the Dominion government, the stations occupied since 1908 are limited to the provinces of Manitoba, Saskatchewan, Alberta and British Columbia. The districts where meridian, base line and subdivision surveys have been in operation since that date have been dotted with stations for the magnetic declination. A special effort has been made to gather magnetic data from the settled districts by means of travelling parties employed on miscellaneous surveys. These surveyors generally cover a wide stretch of country and provide the only means now at our disposal of observing the magnetic elements in the settled parts of western Canada.

DECLINATION.

Description of Compass.

The determination of the magnetic declination is made by means of a trough compass attached to the standards of the transit theodolite used on the Dominion Land

surveys. The needle is made as light as possible in order to reduce friction on the pivot to a minimum. The graduation of the end blocks consists of a single fine line and readings are made on both ends of the needle. The range of readings of a first-class needle, well balanced, and in the hands of a competent observer, can be expected not to exceed two minutes. The original method of attaching the compass to the standards consisted of a hook at one end and a thumb-screw at the other, but as this was not always found to be satisfactory, the hook was discarded, and the compass attached by thumb-screws at both ends.

Method of Observing.

The method adopted for the determination of the magnetic meridian is given in Appendix C of the Manual of Instructions for the Survey of Dominion Lands. The observer is instructed to proceed as follows and to note the following remarks:—

1. Place the instrument on a section line and after adjustment set the vernier to read the astronomical bearing of the line.

2. Release the lower clamp, direct the telescope on the line and fasten the lower clamp.

3. Release the vernier clamp and turn the vernier plate until the north end of the magnetic needle, observed with a magnifying glass, is seen exactly opposite the zero mark. Tap the trough lightly with the pencil or hit the milled parts of the foot screws with the finger nail to be sure that the needle has taken the position of rest. Note the reading of the horizontal circle. Take several readings by repeating the operation.

4. Repeat operation No. 3 for the south end of the needle.

5. Enter in the notes the place of observation, date, hour of the day, weather and other remarks, if any. It is important to record auroras occurring within 24 hours of the time of observation.

The observations should be taken only when the needle is nearly stationary, as in the afternoon after 5 P.M., if possible.

In taking the needle out of the trough, whether to rebalance it or to clean the agate, care should be taken to see that it is put back in its proper position. If replaced in the reverse position the index correction would be altered. For this reason, to safeguard against error, the position of the compass whether 'compass west' or 'compass east,' should be entered in the remarks after each observation when observing.

The returns should also state whether the observations are recorded in the mean time of the place or standard time.

The direction of the magnetic needle is subject to a daily fluctuation called the diurnal variation. During the greater part of the night the direction is not far from normal. In the early morning the north end of the needle in Canada moves towards the east, reaching its maximum deflection about 7 or 8 A.M. The motion is then reversed, the north end travelling westward, and crossing the normal direction about 10 or 11 A.M. The extreme western position is reached in the afternoon and then the needle comes back to its normal position at some time after 5 or 6 P.M. This march is subject to wide variations during magnetic storms. The magnitude of the diurnal variation is not constant. Observations at both eastern and western elongations of the needle on the same day, that is between 7 and 8 A.M. and between 1 and 2 P.M., give the best results and it is desirable that when convenient they may be taken then. This gives not only the best value for the declination, but also the diurnal variation which it is very useful to know. Failing this, however, the best time to observe is after 5 P.M. when the needle is about in its normal position. It is true that the normal position in crossed generally between 10 and 11 A.M. but the motion being very rapid and the time of crossing uncertain, the afternoon observation is preferable.

The place of observation must be at least three or four hundred yards away from wires carrying direct electric current. There must be no iron near the instrument

The observer must make sure that he has no iron or nickel on his person. If any magnetic object is not brought closer to the needle than fifteen or twenty times the distance at which an appreciable deflection is first produced, the effect on the needle is negligible in observations of this kind. Avoid transportation of the instrument on electric cars as there are instances of the polarity of the needle being reversed in such an intense magnetic field.

If the needle is sluggish the observation cannot be accurate. The sluggishness is generally due to a dull pivot or a scratched cap. To keep both in proper condition the needle must always be lowered gently on its pivot and never be allowed to play except when actually in use.

Instrumental constant.

Through the courtesy of the Director of the Meteorological Service at Toronto, the index correction of every instrument used for observing was determined both at the beginning and at the close of the survey season, whenever possible. If a serious discrepancy was found between the two determinations, it was investigated and the observations taken with the instrument rejected unless the cause of the discrepancy could be satisfactorily explained.

Reduction of observations.

In order to give a character of homogeneity to the declination observations, a reduction to a common epoch had to be applied to the observed data. To accomplish this a knowledge of the diurnal and secular variation is necessary. Again as the diurnal variation is subject to extreme fluctuations magnetic storms must be detected. The only method at our disposal for reduction was making use of the daily records of the declinometer at Agincourt, but the observatory being far away from where our observations had been taken, it was thought advisable to compare by actual experiments the fluctuations of the compass in western Canada and those at Agincourt. An observer was instructed to observe the magnetic declination at Rosthern, Sask., during the whole of November, 1910. Rosthern was occupied on account of being advantageously situated as a base station. The observations were taken from 7 A.M .to 4 P.M. at periods ranging from half an hour to one hour, care being taken to observe the needle at its two elongations. The work was carried out in a small silk tent in order to shelter the instrument from the influence of the wind and storms.

A comparison of the results of these observations with a diurnal variation observation taken at Jasmin, Sask., on July 10, 1910, disclosed a diurnal range of the compass in July almost double of that at Rosthern in November.

Later, in the office, copies of the photographic traces of the declinometer at Agincourt were made for the days on which diurnal variation observations had been taken in the western provinces. On these copies were plotted the diurnal variation observations taken in the West so as to correspond in mean local time to the traces of the declinometer, and the points were joined by straight lines. From this investigation useful information was derived for the reduction of our magnetic declinations. According to our expectations mostly all magnetic disturbances shown on the traces of the declinometer were recorded on the diurnal variation curve and both occurred at practically the same instant.

Tables I and II show the comparison of results which has led us to adopt the use of the magnetic records of Agincourt for the reduction of our declination observations. It shows that this method of reduction is well worth the trouble, the precision of the resulting declination being apparently increased about two and one half times. It is felt, however, that this is not much more than a 'make shift' a case of 'doing the best you can with what you have,' and that what we require for proper reductions are the records of an observatory in the Northwest.

In applying reductions the observations have been reduced to the mean of the month of the year in which they were taken. To reduce an observation to the mean of the month, the following procedure was adopted: a tabulation of the mean monthly declinations of each year was obtained from the magnetic observatory at Agincourt. The declination, for the corresponding date and mean local time at which the observation to be reduced was taken, was scaled from the trace of the declinometer at Agincourt. If the trace showed the declination then fairly steady the difference between the mean declination of the month and the actual declination scaled from the trace was applied as a correction to the observation.

To reduce an observation to January of the same year, the difference between the mean declination of the month in which the observation was taken and the mean declination of January was applied to the observation reduced to the mean of the month.

In the absence of any definite knowledge of the secular variation a plus correction of three minutes per year, which agrees closely with the mean secular variation of the corresponding western portion of the United States as shown on the isogonic map of the United States Coast and Geodetic Survey published in 1905, was adopted for the reduction of our declination observations to January 1st, 1912 (1912.0). From the few stations in the West which have been reoccupied this would appear to be a close approximation, and the maximum error from this general assumption cannot be large as the period for reduction covers only three years.

Compilation of Isogonic Map.

In the compilation of the isogonic map accompanying this report the reduced observations only were made use of, except in districts where no other data were available, in which case the declinations as observed were used and the curves of equal declination shown in dotted lines. The observations used for the compilation of this map are appended in Table 4. The observations are arranged in the order of township and range, and the date of each observation is given to the nearest tenth of the year. Column six gives the actual observed declination before any reductions have been applied, and column seven gives this declination reduced to the period 1912.0.

Dip and Total Force.

During the season 1908 dip and total force observations were taken by Mr. J. E. Morrier, D.L.S., at Norway House, Oxford House, Fort Churchill and York Factory.

In 1910 similar observations were taken by Mr. C. Engler, D.L.S., during his trip from Athabaska Landing to Fort Smith and subsequently by Mr. J. A. Cote at different points between Edmonton and Calgary. Unfortunately the results of these observations were lost during a fire at Carstairs, Alberta.

During the miscellaneous surveys made by Mr. P. A. Carson, D.L.S., in 1910, about 24 stations were occupied for dip and total intensity, between Swan River, Man., and Lashburn, Sask. Every complete observation consisted of a dip, a total force and a dip, the mean dip being used in working out the total force. This complete observation was generally duplicated at every station. In some instances the same station was reoccupied during the season and the results compared with those already obtained.

The instruments used for the determination of these magnetic elements were Dover dip circles, the constants of which where determined both before and after every season's work. The total force constant was the mean of at least six observations.

The results of the observations for dip and total force are given in Table 3.

The following is a copy of the "Directions for the use of the dip circle and attachments in observing for magnetic declination, dip and total force."

Selection of Stations.

The conditions to be satisfied in choosing a magnetic station are freedom from present and probable future local disturbance, combined with convenience of access. Proximity of electric railways, masses of iron or steel, gas or water pipes, buildings of stone or brick, should be avoided. A quarter of a mile from the first, 500 feet from the second, 200 feet from the third and fourth may be considered safe distances. The station should be at least 50 feet from any kind of building. If any doubt arises in the selection of a station on account of the possible existence of local disturbances, two intervisible points a hundred yards or more apart should be selected and the magnetic bearing of the line joining them observed at both. A lack of agreement between the two results is evidence of local disturbance.

When taking the observations, the instrument box, especially the bar magnets, should be 40 or 50 feet away for the declination observation and 25 or 30 feet for the dip and total force observations. All knives, &c., should be removed from the person. It should be noted also that iron is frequently present in buttons, hats, neckties, etc.

Care and Adjustment of Instrument.

Care should be taken to keep the instrument in good adjustment, clean and free from dust. A camel hair brush, pith, chamois and tissue paper are supplied for that purpose and will be found in the box.

The dipping needles should be carefully guarded against moisture, and after use should always be wiped dry with chamois or tissue paper. They should be put back in the box with poles of opposite polarity at the same end and should be magnetised afresh for each station.

The bar magnets should be touched with the hands as little as possible and should always be wiped with chamois or tissue paper after the observation to prevent rusting. They should not be allowed to touch each other except at their opposite poles and, when placed in the box, the ends of opposite polarity should be connected by a soft iron armature.

The instrument is levelled in the ordinary way with the plate level.

Magnetic Declination.

1. The trough compass supplied should be attached to the upper horizontal plate by means of the two thumb-screws and the telescope to the vernier arms of the vertical circle. The observation for magnetic declination is then taken and recorded in accordance with the instructions given for magnetic declination observations with the D.L.S. pattern transit.

2. The magnetic meridian may also be determined by means of the dipping needle. Set the vertical circle verniers to read 90° and revolve the instrument in azimuth until the needle is bisected by the microscopes and read the horizontal circle. As the dipping needle points vertically when in the magnetic prime vertical, in this way the magnetic prime vertical is found and by applying 90° the magnetic meridian.

The magnetic meridian found in this manner is sufficiently accurate, however, only for the dip and total force observations. Method No. 1 is preferable and should always be adopted when possible.

Magnetic Dip.

The needles for the dip observations are carried on the lid of the instrument box. Taking out one of these needles carefully wipe with tissue paper and clean the pivots with pith and having also carefully cleaned the agate planes in the box with pith, place the needle on the brass v's with the face of the needle to the face of the instrument. (The face of the needle is that side which is lettered, the face of the instrument that

side which is graduated.) Turn the instrument in azimuth until it lies in the magnetic meridian (previously determined in the declination observation) and with its face to the east, and lower the needle gently on the agate planes. It will now swing in the approximate position of the dip. When it settles it ought to be slightly raised and lowered once or twice by means of the screw, so as to ensure its being exactly in the centre of the instrument. The vernier arm of the vertical circle is now turned until the north, that is the lower end, is seen to be bisected by the crosshair of the microscope; the lower vernier is then read. Similarly, the upper end is bisected by the upper microscope and the upper vernier read; the needle is then slightly disturbed by the screw and the readings repeated until there are three readings for each end. The instrument is now turned 180° in azimuth so that the face of the instrument is now west and the same number of readings taken for this position. The needle is then taken out of the glass box and reversed end for end of its axis, so that it faces the other way. The six readings are again taken as before for both ends of the needle.

The needle is then taken out of the box, and its polarity reversed in the following manner. Put the needle on the reversing block, face up and secure by the brass centre piece which is intended to protect the axis. Place the reversing block so that the north end of the needle will be on the right hand and the south end on the left. Now take the bar magnets one in each hand, the north pole of the magnet in the right hand lowermost and south pole of the magnet in the left hand, and bring the opposite poles of the two magnets down on the needle near its centre and one on each side of the brass centre piece. Draw them slowly and steadily outwards over the needle, carrying them over its ends and lifting them some inches above the level of the needle, bring them back to the middle position again and repeat. This should be done five times. Care should be taken to have the motion as nearly parallel to the axis of the needle as possible; the ledge on each side of the reversing block is intended to act as a guide for the magnets to ensure this. The needle is then put face down in the reversing block and the operation repeated in the same way. The polarity of the needle will then be completely reversed.

The observations taken before reversal are now repeated. The mean of the observed inclinations in the eight positions is the dip.

It will be noticed that the mean resulting dip will, by the *reversal* of the *dip circle,* be free from any small error in the verticality of vertical axis and also eliminate index error of vertical circle; that the *reversal* of the face of the needle on the agates will eliminate the error caused by any want of perpendicularity of the axis of the needle to the needle; that the *reversal* of the *polarity* will correct for any want of balance of the two ends of the needle.

Total Force.

The total intensity may be determined with a dip circle by Lloyd's method when suitable standardization observations have been made at a station where the dip and intensity are known. This method involves first the determination of the angle of dip with a loaded needle, and second, a determination of the angle through which another needle is deflected by the loaded needle when the latter is placed at right angles to it in the place provided between the reading microscopes and protected by the brass shield. As the determination of total intensity by this method is relative, it is necessary to guard, as far as possible, against any change in the magnetism of the two needles and to use the same weight in the field as during the standardization observations. Their polarities *must never be reversed,* therefore, and they must not be allowed in close proximity to the bar magnets when these are being used to reverse the polarity of the regular dip needles. They are found in the copper box at the bottom of the instrument box. The needle which is weighted with the small wire is the loaded needle and is called the 'statical needle'; the other is called the 'dipping needle.' *Neither of these needles must ever be touched with the bar magnets.* Turn the instrument into the magnetic meridian with its face to the east. Revolve the vertical ver-

niers until the tangent screw points to the north. By means of the small brass clips, attach the statical needle to the vernier plate with its face to the east and its north end next to the tangent screw and put the brass protecting shield in position over it. Place the dipping needle in the usual way on the agate plates, now, moving the vernier arms, read the inclination of the swinging needle as before, both north and south ends, then reverse the vertical vernier plate so that the tangent screw is south of the centre and read the inclination again. It should be noted here that the vertical circle is graduated into quadrants from 0 to 90 degrees, and that these inclinations should always be read from the north zero, so that if in the first part of the observation, the north end of the dipping needle should be deflected by the statical needle past the vertical line, the reading to be entered is 180 degrees less the actual vernier reading, and, if in the latter part of the observation, the north end of the dipping needle be deflected above the horizontal, the vernier must be entered with a minus sign. The algebraic difference of the two readings is twice the deflection.

The dipping needle is now put away. The statical needle is taken off the vernier plate and placed on the agates, its inclination is now read in four positions in the same way as in an observation for dip, that is, instrument face east, needle face east, instrument west, needle west. Instrument west, needle east. Instrument east, needle west.

Frequency and Time of Observations.

The observations should be taken at least twice at each station whenever possible. Should the two observations not agree within 5 or 6 minutes a third observation should be taken. The most desirable time of day to observe is about the time of eastern and western extremes of declination say at 8 A.M. and 1 P.M., and it is suggested that when convenient these times be adopted.

Suitable forms for the observations are provided. The constant "A" used in the form is a constant for the two total force needles. That and the index correction to the compass have to be determined at the magnetic observatory at Agincourt.

TABLE No. 1.

COMPARISON of the Daily Declination Observations taken by D. E. Chartrand at Rosthern in November, 1910, with Agincourt Magnetic Observatory Record.

AGINCOURT ROSTHERN.

Time	Nov. 1.	Nov. 2.	Nov. 3.	Nov. 4.	Nov. 5.	Nov. 7.	Nov. 10.	Nov. 11.	Nov. 12.	Nov. 14.	Nov. 15.
7.00	30·0	27·0	26·0	29·0	31·5	27·0	39·5	31·0	32·0	30·0	28·0
7.30	27·5	24·5	27·0	32·0	31·5	28·0	37·5	29·5	30·5	30·0	31·0
8.00	26·0	28·0	27·5	24·5	31·3	26·5	29·0	30·5	30·5	30·5	33·5
8.30	28·0	27·0	26·5	25·5	30·0	29·2	29·0	30·0	30·5	35·0	30·0
9.00	27·0	30·0	29·0	30·0	31·0	33·0	25·5	33·0	31·5	34·5	29·0
9.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10.00	23·0	30·0	27·0	31·0	30·0	27·5	29·0	28·5	32·0	32·5	30·5
11.00	26·5	28·0	26·0	27·5	31·0	26·0	28·5	30·0	31·0	31·5	31·0
11.30	25·5	26·0	26·5	26·5	29·2	27·5	29·5	32·0	31·0	30·5	31·0
12.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12.30	26·0	26·0	26·5	30·0	30·0	28·0	30·5	31·2	30·0	30·5	31·0
1.00	26·5	26·5	30·0	31·0	29·0	28·5	32·0	31·0	27·5	32·5	31·0
1.30	26·0	26·0	28·0	29·0	30·0	28·0	34·5	30·0	27·5	32·0	30·0
2.00	26·0	27·0	29·5	30·0	29·5	27·0	.....	30·0	26·5	30·0	34·0
2.30	27·0	28·5	28·0	34·8	30·5	30·5	.....	30·0	32·0	30·0	28·0
3.00	26·0	29·0	28·5	31·5	30·0	29·0	.....	29·0	31·0	28·0	30·0
1.00	25·0	29·0	30·5	35·0	33·0	31·0	.....	31·0	30·8	31·0	31·0
1.30	25·5	30·0	30·0	32·0	35·5	34·0	.....	30·5	30·5	33·0	30·0
Mean	26·31	27·66	27·91	29·96	30·81	28·79	31·32	30·45	30·30	31·34	30·56
Residuals	+3·66	+2·34	+2·59	+5·04	+4·69	+5·21	+8·18	+2·55	+1·70	+3·66	+3·44
	3·31	3·16	2·91	5·46	1·81	2·79	5·82	1·95	3·80	3·34	2·56

TABLE No. 1—*Concluded.*

COMPARISON of the Daily Declination Observations taken by D. E. Chartraud at Rosthern in November, 1910, with Agincourt Magnetic Observatory Record—*Concluded.*

AGINCOURT -ROSTHERN—*Concluded.*

Time.	Nov. 16.	Nov. 17.	Nov. 21.	Nov. 22.	Nov. 23.	Nov. 24.	Nov. 25.	Nov. 26.	Nov. 27.	Nov. 30.
7 00.	28·0	.. ..	33·0	.....	.....	.....	.....	.....	.....	.....
7 30.	39·0	.....	31·5	26·0	30·0	31·0	29·0	21·0	30·5	24·0
8 00.	34·0	.....	32·0	31·5	30·0	30·5	33·5	25·0	35·0	31·5
8 30.	26·5	30·0	32·0	35·0	30·0	32·0	29·5	26·5	37·5	27·5
9 00.	26·5	33·0	31·0	30·0	29·7	32·5	29·0	29·5	35·5	28·0
9 30.	.....	.....	.....	.....	28·0	32·0	27·0	.....	.....	30·0
10 00.	28·5	26·5	38·5	32·5	28·0	34·0	27·5	28·0	32·5	30·0
11 00.	28·5	32·0	35·0	37·0	29·0	34·5	32·5	31·5	30·5	33·5
11 30.	29·0	30·0	32·0	35·0	29·0	32·5	34·0	31·5	.....	29·0
12 00.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12 30.	31·0	31·5	30·0	26·0	32·5	25·0	34·5	30·0	31·5	31·5
1 00.	27·5	29·0	28·5	23·0	31·0	24·0	30·5	29·5	32·0	36·5
1 30.	28·5	.....	30·8	30·0	28·0	25·0	34·0	29·5	.....	31·5
2 00.	30·0	.. ..	31·5	36·5	29·5	33·0	34·5	28·0	35·5	31·0
2 30.	37·0	.....	26·5	27·0	33·5	27·5	29·0	29·5	34·0	32·0
3 00.	29·5	.....	29·0	30·0	33·0	28·5	30·0	29·5	31·5	29·5
4 00.	33·0	.....	30·5	28·0	32·0	30·5	32·0	29·5	32·5	27·5
4 30.	28·0	.....	31·5	25·5	28·0	.....	.....	.....	.....	.....
Means	30 22	30·29	31 46	30 10	30 07	30 17	31 10	28 46	32·81	30 20
Residuals	-3 78	-2 71	-7 04	-6 59	-3 43	-4 33	-3 49	-3 04	-4 69	-6·30
	3 72	3 79	4 96	7 10	2 07	6 17	4 10	7 46	4 81	6 20

	−0 03
Mean for the month	+9 47
	−9 03
Mean residual	=2·29

TABLE No. II.

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction and as obtained by Reduction from Magnetic Observatory Records at Agincourt.

Time	NOVEMBER 1.				NOVEMBER 2.				NOVEMBER 3.				NOVEMBER 4.				NOVEMBER 5.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v
	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
7.00	24 76 2	+04 3	24 72 7	+00.8	24 75 3	+03.4	24 74.8	+02.9	24 77.7	+05.8	24 76.2	+04 3	24 77.2	+05.3	24 73.7	+01.8	24 73.3	+01.4	24 70 8	−01 1
7.30	24 78.7	+06 8	24 75 2	+03 3	24 78.2	+06.3	24 77 7	+05.8	24 77.2	+05.3	24 74.7	+02.8	24 74.5	+02 6	24 70 5	−01 4	24 71 6	+02 7	24 70.6	−01 3
8.00	24 79 5	+07 6	24 76.0	+04.1	24 76.9	+05 0	24 73 4	+01 5	24 77.5	+05.6	24 75.0	+03 1	24 82 2	+10 3	24 77 7	+05.8	24 73 9	+02.0	24 70.4	−01.5
8.30	24 78.2	+06 3	24 71 7	+02.8	24 78 4	+06.5	24 75.4	+03.5	24 77.7	+05.8	24 75.2	+03 3	24 80.7	+08 8	24 77.2	+05.3	24 75.9	+04.0	24 72 9	+01.0
9.00	24 77 2	+05 3	24 75.2	+03.3	24 74.8	+02.9	24 72.3	00.4	24 75.6	+03.7	24 73.1	+01.2	24 75.2	+03.3	24 71 7	−00 2	24 73.4	+01.5	24 70.9	−01.0
10.00	24 77 7	+05 8	24 79 2	+07 3	24 71 5	00.4	24 72 0	+00.1	24 74.7	+02.8	24 75.2	+03.3	24 71.4	−00.5	24 71.9	00.0	24 72 8	+00 9	24 72 3	+00 4
11.00	24 72 2	+00 3	24 75.7	+03.8	24 71.9	00 0	24 71 4	+02 5	24 72.8	+00.9	24 76.3	+04.4	24 70.2	−01 7	24 74 7	+02.8	24 69 5	−02.4	24 71 0	−00 9
11.30	24 73.1	+01 2	24 77.6	+05.7	24 72 3	+00.4	24 75.8	+03.9	24 72.2	+00.3	24 75.7	+03 8	24 69.8	−02 1	24 75 8	+03.9	24 69.9	−02 0	24 72 9	+01 0
12.30	24 72 2	+00.3	24 76 7	+04 8	24 72 1	+00.2	24 76 6	+04.7	24 70.9	−01.0	24 75.4	+03.5	24 67.5	−01 4	24 72 0	+00.1	24 69.3	−02 6	24 72 3	+00.4
1.00	24 72 5	+00 6	24 76.0	+04 1	24 71.5	+00.4	24 76.0	+04 1	24 68.3	−03 6	24 72 8	+00 9	24 67.0	−04 9	24 71 0	00 9	24 70.9	−01.0	24 73.4	+01 5
1.30	24 73.5	+01.6	24 76 5	+04 6	24 72 3	+00 4	24 76 8	+04.9	24 70.2	−01.7	24 73 7	+01.8	24 70.0	−01.9	24 73 0	+01 1	24 70.1	−01.8	24 72 1	+00 2
2.00	24 74 1	+02 2	24 76 6	+04 7	24 72 1	+00.2	24 75.1	+03.2	24 69.9	−02.0	24 72.9	+01.0	24 69.0	−02.9	24 72 0	+00.1	24 70 9	−01.0	24 72.4	00 5
2.30	24 74.2	+02 3	24 71 7	+02.8	24 72 7	+00.3	24 74 2	+02 3	24 71.1	−00.8	24 74.1	+02 2	24 65.1	−06 8	24 68.1	−03.8	24 70.3	−01 6	24 71.3	00 6
3.00	24 76.0	+04 1	24 75 5	+03.6	24 73 0	+01.1	24 73.5	+01.6	24 71.5	−00.4	24 74.0	+02.1	24 68.3	−03 6	24 70.8	−01.1	24 69.4	−02 5	24 70 9	−01 0
4.00	24 77 4	+05 5	24 76 9	+05 0	24 73 0	+01.1	24 72.5	+00.6	24 70.7	−01.2	24 71.2	−00.7	24 65.7	−06.2	24 68.2	−03 7	24 68.9	−03.0	24 69 4	−02.5
4.30	24 76 0	+04.1	24 75 5	+03.6	24 72.1	+00 2	24 71.6	−00.3	24 71.2	−00.7	24 71.7	−00.2	24 68 0	−03.9	24 70 5	−01 4	24 66.2	−05.7	24 66 7	−05 2

TABLE No. 11—*Continued.*

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction, &c.—*Continued.*

Time.	NOVEMBER 7.				NOVEMBER 8.				NOVEMBER 9.				NOVEMBER 10.				NOVEMBER 11.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.
	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
7.00	24 75 6	+03 7	24 75 1	+03 2	24 75 0	+03 1	.....	.....	24 72 9	+01 0	.....	.....	24 65 6	−06 3	24 63.1	−08.8	24 72.6	+00 7	24 70 6	−01.3
7.30	24 77.1	+05 2	24 74 1	+02 2	24 75 1	+03 3	.....	.....	24 75.2	+03 3	.....	.....	24 65 7	−06 2	24 65 2	−06 7	24 74 9	+03 0	24 72.9	+01.0
8.00	24 78 4	+06 5	24 75.9	+01 0	24 74 8	+02 9	.....	.....	24 76 7	−05 2	.....	.....	24 74 0	+02.1	24 73 5	+01 6	24 71 1	+02 2	24 71.6	−00.3
8.30	24 76.9	+05 0	24 72 9	+01 0	24 69 4	−02 5	.....	.....	24 76.8	−05 1	.....	.....	24 74.8	+02.9	24 73 3	+01.4	24 76 2	−04 7	24 72 7	+00.8
9.00	24 73 7	+01 8	24 69.2	−02 7	24 73.5	+01 6	.....	.....	24 74.9	+03 0	.....	.....	24 75 8	+03 9	24 76 3	+04 4	24 72.9	+01 0	24 69 4	−02.5
10.00	24 75 1	+03 2	24 73 6	+01 7	24 73 8	+01 9	.....	.....	24 76 8	+04 9	.....	.....	24 73 7	+01 8	24 72 7	+00 8	24 75 0	+03 1	24 73.5	+01.6
11.00	24 73 5	+01 6	24 76 0	+04 1	24 72 5	+00 6	.....	.....	24 71 7	−00 2	.....	.....	24 73 7	+01 8	24 73 2	+01 5	24 72 1	+00.2	24 71 6	−00.3
11.30	24 71 6	−00 3	24 75 1	+03 2	24 69 8	−02 1	.....	.....	24 73 8	+01 9	.....	.....	24 72 0	+00 1	24 72 5	+00 6	24 69 3	−02 6	24 69 8	−02.1
12.30	24 65 7	−03 2	24 74 2	+02 3	24 63 6	−08 3	.....	.....	24 66 8	−05 1	.....	.....	24 61 5	−02 4	24 72 0	+00.1	24 65 1	−05 8	24 71 1	−00.8
1.00	24 68 0	−03 9	24 73 5	+01 6	24 66.1	−05 8	.....	.....	24 65.2	−06 7	.....	.....	24 67 9	−04 0	24 70 4	−01 5	24 67 6	−04 3	24 72 1	+00.2
1.30	24 68 9	−03 9	24 74 0	+02 1	24 69 8	−02 1	.....	.....	24 67 7	−04 2	.....	.....	24 66 0	−05.9	24 68 5	−03 4	24 68 3	−03 6	24 72 8	+00.9
2.00	24 69 9	−02 0	24 74 4	+02 5	24 65 9	−06 0	.....	.....	24 64 9	−07 0	.....	.....	24 70 9	−01 0	.....	.....	24 68.3	−03 6	24 72 8	+00.9
2.30	24 69 1	−02 8	24 71 6	−00 3	24 64 6	−07 3	.....	.....	24 65 9	−06 0	.....	.....	24 69 8	−02.1	.....	.....	24 69 6	−02 3	24 73 1	+01.2
3.00	24 70 1	−01 8	24 72 6	+00 7	24 72 8	+00 9	.....	.....	24 73 0	+01 1	.....	.....	24 72 2	+00 3	.....	.....	24 71 0	−00 9	24 73 5	+01.6
4.00	24 70 4	−01 5	24 70 9	−01 0	24 66 5	−05 4	.....	.....	24 71.7	−00 2	.....	.....	24 65.7	−06 2	.....	.....	24 70 3	−01 6	24 70 8	−01.1
4.30	24 66 8	−05.1	24 68 3	−03 6	24 71 1	−00 8	.....	.....	24 69.8	−02 1	.....	.....	24 79 4	+07 5	.....	.....	24 70 4	−01 5	24 70.9	−01.0

TABLE No. II—*Continued.*

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction, &c.—*Continued.*

Time.	NOVEMBER 12.				NOVEMBER 14.				NOVEMBER 15.				NOVEMBER 16.				NOVEMBER 17.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.
	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
7.00	24 72.2	+00 3	24 69.7	−02 2	24 76 0	+04 1	24 72 5	+00.6	24 74.9	+03.0	24 72 4	+00.5	24 74.6	+02 7	24 73.6	+01.7	24 69 8	−02 1	.....	.....
7.30	24 73.6	+01.7	24 71 1	−00 8	24 75 4	+03.5	24 71.9	00 0	24 73.8	+01.9	24 71.3	00.6	24 64.0	−07.9	24 63.0	−08.9	24 72 8	+00 9	.....	.....
8.00	24 73.7	+01 8	24 71 2	−00.7	24 75.1	+03.2	24 71.6	−00.3	24 72.5	+00.6	24 69 0	−02.9	24 69.1	−02 8	24 68.1	−03 8	24 68 3	−03.6	.....	.....
8.30	24 74.2	+02.3	24 70.7	−01.2	24 71.5	−00.4	24 68.0	−03.9	24 74.7	+02.8	24 72.2	+00 3	24 75.8	+03.9	24 75.3	+03.4	24 67 5	−04.4	24 72.5	+00 6
9.00	24 73.9	+02.0	24 70.9	−01.0	24 72 0	+00.3	24 68.5	−03.4	24 74.5	+02.6	24 73.0	+01.1	24 74.7	+02.8	24 75.2	+03.3	24 68 4	−03 5	24 69.9	−02.0
10.00	24 72 9	+01.0	24 70.4	−01 5	24 72.6	+00.7	24 70.1	−01.8	24 71.5	−00.4	24 71.0	−00.9	24 75.8	+03.9	24 74 3	+02.4	24 73 0	+01 1	24 75.5	+03.6
11.00	24 70.3	−01.6	24 71.3	−00 6	24 67.8	−04.1	24 70.8	−01.1	24 69.7	−02.2	24 71.7	−00 2	24 73.1	+01.2	24 73.6	+01.7	24 70 3	−01 6	24 69.8	−02.1
11.30	24 68.7	−03.2	24 71 2	−00 7	24 69 1	−02.8	24 71.6	−00 3	24 68.5	−03.4	24 71.0	−00 9	24 72.4	+00.5	24 73.9	+02.0	24 69 9	−02 0	24 71 9	00.0
12.30	24 68 3	−03.6	24 71.8	−00 1	24 66.7	−05 2	24 71.2	−00.7	24 67.1	−01.8	24 71.6	−00.3	24 67.8	−04.1	24 71.3	−00.6	24 67 0	−04 9	24 70.5	−01.4
1.00	24 69 2	−02 7	24 74 7	+02 8	24 66 0	−05.9	24 70 0	−01.9	24 66.0	−05.9	24 71.5	−00.4	24 71 3	−00.6	24 74.8	+02 9	24 68 7	−03.2	24 72.7	+00.8
1.30	24 69.2	−02.7	24 71 7	+02.8	24 66.3	−05.6	24 69.8	−02.1	24 67.1	−04.8	24 72.1	+00 2	24 70.4	−01.5	24 73.4	+01.5	24 68 9	−03.0	24 71.9	00.0
2.00	24 70.8	−01.1	24 75.3	+03 4	24 68 9	−03 0	24 72 4	+00 5	24 64.3	−07.6	24 68.8	−03.1	24 70.1	−01.8	24 72.6	+00.7	24 68.7	−03.2	24 75.7	+03.8
2.30	24 67.1	−04.8	24 70 6	−01 3	24 69.4	−02 5	24 72.9	+01.0	24 70.2	−01.7	24 74.2	+02.3	24 62 5	−09.4	24 65.0	−06 9	24 72 2	+00.3	24 69.6	−02.3
3.00	24 68.4	−03.5	24 70.9	−01 0	24 70 6	−01 3	24 74.1	+02.2	24 69.0	−02.9	24 72.0	+00 1	24 72 0	+00.1	24 74 0	+02 1	24 66.6	−05.3	24 72.3	+00.4
4.00	24 69.3	−02.6	24 71.3	−00 6	24 70 0	−01 9	24 70.5	−01.4	24 69.1	−02.8	24 71.1	−00.8	24 68 3	−03.6	24 69 8	−02.1	24 69 8	−02.1	24 63.2	−08.7
4.30	24 69.7	−02.2	24 71.2	−00.7	24 68 9	−03.0	24 69.4	−02.5	24 70.9	−01.0	24 72.4	+00.5	24 72.1	+00.2	24 74.6	+02.7	24 67.7	−04.2	.....	.. .

TABLE No. II—*Continued.*

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction, &c.—*Continued.*

Time.	November 18.				November 19.				November 21.				November 22.				November 23.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl	v.
	° ′	′	° ′	′	′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
7.00	24 55 7	−16 2	.....	.....	24 57 2	−14 7	.....	.....	24 71 4	−00 5	24 69 9	−02.0	.....	.....	.....	.....	.....	.....	.....	.....
7.30	24 69 2	−02 7	.....	..	24 59 5	−12 4	.....	.....	24 72 5	+00 6	24 71 0	−00 9	24 72.5	+00 6	24 77 0	+05 1	21 75 3	+03 4	24 72.8	+00.9
8.00	24 66 2	−05 7	.....	..	24 57.1	−14 8	.....	.....	24 72 2	+00 3	24 69.7	−02 2	24 72 2	+00 3	24 70.7	−01 2	24 75.1	+03.2	24 72.6	+00.7
8.30	24 55.1	−16 8	.....	..	24 52 9	−19 0	.....	.....	24 73.0	+01 1	24 69 5	−02 4	24 72.0	+00 1	24 67.5	−04.4	24 75 1	+03 2	24 72.6	+00.7
9.00	24 59 2	−12.7	.....	..	24 58.3	−13 6	.....	....	24 73.7	+01 8	24 71.2	−00.7	24 74 2	+02.3	21 72 7	+00 8	24 75.3	+03 4	24 72 8	+00.9
9.30	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	24 75.5	+03 6	24 74.0	+02.1
10.00	24 64 7	−07.2	.....	..	24 70 5	−01.4	....	....	24 66.5	−05 4	24 64 0	−07 9	24 70 3	−01 6	24 69.8	−02 1	24 74 6	+02 7	24 74 1	+02.2
11.00	24 64 4	−07.5	.....		24 52 3	−19.6	.....	.....	24 67.7	−04 2	24 67 2	−04 7	24 64 4	−07 5	24 64 9	−07.0	24 71 8	−00 1	24 73 3	+01.4
11.30	24 59 2	−12.7	.....	.	24 49 0	−22 9	.....	....	24 68.3	−03 6	24 69 8	−02.1	24 63 2	−08 7	24 66 7	−05 2	24 69 6	−02.3	24 73 6	+01.7
12.30	24 58 9	−13.0	.....		24 56 2	−15 7	.....	.....	24 69.1	−02 8	24 72.6	+00.7	24 68 9	−03 0	24 76.4	+04 5	24 64 5	−07.4	24 70.0	−01.9
1.00	24 63 0	−08 9	.....	..	24 58 6	−13 3	.....	....	24 69.9	−02 0	24 73.4	+01.5	24 70 8	−01 1	24 78 8	+06 9	24 66.2	−05.7	24 71.7	−00.2
1.30	24 66 2	−05 7	.....	...	24 50 2	−12 7	.....	.....	24 68.2	−03.7	24 71.7	−00 2	24 66 2	−05 7	24 71 7	−00 2	24 69 1	−02.8	24 74.6	+02.7
2.00	24 65.8	−06 1	.....	.	24 62 0	−09 9	.....	.....	24 67.5	−04 4	24 71.0	−00.9	24 61.0	−10 9	24 65.5	−06 4	24 67 9	−04 0	24 72 9	+01.0
2.30	24 76 3	+04 4	.....	..	24 64 1	−07 8	.....	.	24 72.0	+00.1	24 75.5	+03 6	24 70 8	−01.1	24 74 8	+02 9	24 64.3	−07.6	24 68.8	−03.1
3.00	24 68 2	−03.7	.....	....	24 65 2	−06 7	.....	.....	24 70.6	−01 3	24 73 1	+01.2	24 69 3	−02 6	24 72 3	+00.4	24 65 8	−06 1	24 69 3	−02.6
4.00	24 67 9	−04 0	.....	..	24 68 6	−03 3	.....	....	24 70 0	−01.9	24 71.5	−00 4	24 71 6	−00 3	24 75 1	+03 2	24 67.7	−04.2	24 70.2	−01.7
4.30	24 67 2	−04.7	.....	...	24 69 9	−02 0	.....	....	24 70.4	−01 5	24 70 9	−01 0	24 71.7	−00 7	24 73 7	+01 8	24 70 9	−01.0	24 74.4	+02 5

TABLE No. II—*Continued.*

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction, &c.—*Continued.*

Time.	NOVEMBER 24.				NOVEMBER 25.				NOVEMBER 26.				NOVEMBER 27.				NOVEMBER 28.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.
	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′		° ′	′	° ′	′	° ′	′
7.30	24 74.4	+02 5	24 71.4	−00 5	24 75.1	+03 4	24 73.3	+01.4	24 77.8	+05 9	24 80.8	+08.9	24 72.9	+01 0	24 71.9	01.0	24 71 8	−00 1		
8.00	24 74.6	+02 7	24 72 1	+00 2	24 72 1	+00 2	24 68.6	−03.3	24 77.5	+05 6	24 77 0	+05 1	24 68 0	−03 9	24 67 5	−04 4	24 72.1	+00 2		
8.30	24 73.7	+01.8	24 70.2	−01.7	24 75 9	+04 0	24 73.4	+01.5	24 76 5	+04 6	24 75.0	+03.1	24 67 3	−04 6	24 64 8	−07.1	24 56 5	−15 4		
9.00	24 73.5	+01.6	24 70 0	−01 9	24 75.8	+03.9	24 73.8	+01.9	24 76.4	+04.5	24 72.9	+01.0	24 68.1	−03 8	24 65 6	−06.3	24 68.5	−03 4		
9.30	24 72.2	+00.3	24 69.7	−02.2	24 77.6	+05.1	24 75.5	+03.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
10.00	24 69.6	−02.3	24 68.1	−03.8	24 73.5	+01.6	24 75.0	+03.1	24 74.7	+02.8	24 73 2	+01 3	24 69.1	−02 8	24 69 6	−02 3	24 66.3	−05 6		
11.00	24 64.8	−07.1	24 67.8	−04.1	24 67.8	−04.1	24 69.8	−02 1	24 70.0	−01.9	24 71.5	−00 4	24 67.2	−04.7	24 71 7	−00.2	24 58.8	−13 1		
11.30	24 65.2	−06.7	24 70.2	−01.7	24 65 5	−06.4	24 69 0	−02.9	.....	.....	.....	.....	.....	.....	.....	.....	24 64.8	−07 1		
12.30	24 69 2	−02.7	24 76.7	+01.8	24 65.5	−06.4	24 69.0	−02 9	24 68.6	−03.3	24 72.1	+00.2	24 66.9	−05.0	24 70 4	−01.5	24 67.9	−04 0		
1.00	24 70.2	−01.7	24 77.7	+05.8	24 67 9	−04 0	24 71.9	00.0	24 69 5	−02.4	24 73 0	+01 1	24 67 4	−04.5	24 70.9	−01.0	24 69.2	−02.7		
1.30	24 68 8	−03.1	24 76.3	+04.4	24 64.0	−07.9	24 68.5	−03.4	...	...	.....	.....	.....	.....	.....	.....	24 67.3	−04 6		
2.00	24 63 2	−08.7	24 69.2	−02 7	24 63.1	−08.8	24 67.6	−04.3	24 70.2	−01.7	24 74 2	+02 3	24 66 4	−05 5	24 66 9	−05 0	24 58.1	−13 8		
2.30	24 69.3	−02.6	24 74.8	+02.9	24 69 9	−02 0	24 73 4	+01.5	24 69.7	−02 2	24 73 2	+01 3	24 68 1	−03 5	24 67 9	−04.0	24 64 6	−07 3		
3.00	24 70.6	−01.3	24 71.1	+02.2	24 67 5	−04.4	24 72 0	+00.1	24 70.7	−01.2	24 73 2	+01 3	24 68 7	−03 2	24 71 2	+00 7	24 65 0	−06 9		
4.00	24 69.7	−02.2	24 71.7	−00.2	24 66 2	−05 7	24 70.2	−01 7	24 71.1	−00.8	24 73 1	+01 2	24 67 8	−04 1	24 70 3	01 6	24 63.2	−08 7		

TABLE No. II—*Concluded*

COMPARISON of the Magnetic Declination at Rosthern, Sask., as obtained without any Reduction, &c.—*Concluded*

Time.	NOVEMBER 29.				NOVEMBER 30.			
	Without Reduction.		With Reduction.		Without Reduction.		With Reduction.	
	Decl.	v.	Decl.	v.	Decl.	v.	Decl.	v.
	° ′	′	° ′	′	° ′	′	° ′	′
7.30	24 74 5	+02 6	.....	..	24 77 9	+06 0	24 77 4	+05 5
8.00	24 57 5	−14 4	.....	..	24 72 6	+00 7	24 70 6	−01 3
8.30	24 51 4	−20 5	.....	.....	24 77 4	+05 5	24 74 9	+03 0
9.00	24 58 2	−13 7	.....	.....	24 75 9	+04 0	24 73 4	+01 5
9.30	24 58 1	−13 8	.....	..	24 74 4	+02 5	24 72 4	+00 5
10.00	24 60 7	−11 2	.....	..	24 73 0	+03 1	24 71 5	−00 4
11.00	24 59 9	−12 0	.....	.....	24 68 5	−02 4	24 68 0	−03 9
11.30	24 58 0	−13 9	.....	.....	24 70 8	−01 1	24 72 8	+00 9
12.30	24 67 1	−04 8	.....	.....	24 67 5	−04 4	24 71 0	−00 9
1.00	24 68 9	−03 0	.....	.....	24 63 0	−08 9	24 65 5	−06 4
1.30	24 76 1	+04 2	.....	.....	24 66 1	−05 8	24 70 6	−01 3
2.00	24 68 0	−03 9	.....	.....	24 66 1	−05 8	24 70 6	−01 3
2.30	24 65 1	−06 8	.....	.....	24 68 0	−05 9	24 71 5	−00 4
3.00	24 62 0	−09 9	.....	.....	24 67 5	−04 4	24 73 5	+01 6
4.00	24 62 4	−09 5	.....	.....	.....	.....	.....	.....

Mean Declination for November ..... 24° 71′ 9

	Without Reduction.	With Reduction.
Maximum Residual	22′ 9	8′ 9
Mean Residual	.....	2′ 2

TABLE No. 3.

Place.	Tp.	Rge.	Mer.	Date.	Time.	Dip.	Time.	Total Intensity.	Observer.
						° ′			
40·00 W. 10·00 S.—N.E. cor. sec. 18	40	22	3	14 10 10	9.03 A	77 26 8	9 30 A	9 79763	D. E. Chartrand.
" "	40	22	3	14 10 10	9.58 A	77 26 3	10.25 A	9 79777	"
10·00 S. 15·00 E.—¼ p. W. by 31	37	24	3	23 10–10	1.57 P	77 15·2	2 27 P	9·79601	"
" "	37	24	3	23 10 10	2 54 P	77 13 9	3 19 P	9 79632	"
5·00 S.—½ p. E. by sec. 9	21	4	2	15– 6–10	3.30 P	77 42·8	4 10 P	9 80050	"
" "	21	4	2	15 6 10	4.45 P	77 39 7	5 25 P	9 80047	"
" "	21	4	2	15 6–10	5 57 P	77 41 5	.....	.....	"
" "	21	4	2	19 6 10	8.47 A	77 43 5	9 30 A	9 80055	"
" "	21	4	2	19– 6 10	10 07 A	77 43 0	10.40 A	9 80052	"
" "	21	4	2	19 6 10	11 15 A	77 43 6	.....	.....	"
30·00 W. 10 00 S.—N.E. cor. sec. 3	35	1	3	31 7 10	9 18 A	77 34 5	9 51 A	9 80269	"
20 00 S. 3·00 E. " 12	34	3	3	3 8 10	1 45 P	77 38 9	2 27 P	9·80184	"
" "	34	3	3	3 8 10	3 07 P	77 39 8	3 35 P	9 80181	"
22·00 N. 35·00 W S E cor. sec. 9	33	4	3	10 8 10	2 21 P	77 19 7	3 09 P	9 80057	"
15·00 N. 14 00 W. N.E. " 36	38	5	3	12 8 10	2.21 P	77 52·1	2 56 P	9 79928	"
" " 36	38	5	3	12 8 10	3 34 P	77 53 2	4 09 P	9·79937	"
At N.E. cor. sec. 29	22	6	2	9 6 10	2 46 P	77 48 8	3 39 P	9·79976	"
" "	22	6	2	9 6 10	4.24 P	77 48 5	4.54 P	9 80018	"
" "	22	6	2	9 6 10	5.24 P	77 50·3	.....	.....	"
" "	22	6	2	12 6 10	9 49 A	77 49·9	10 36 A	9 80065	"
" "	22	6	2	12 6–10	11 16 A	77 50 5	11.54 A	9 80049	"
" "	22	6	2	12– 6 10	12 24 P	77 50·7	.....	.....	"
22·00 N. 35·00 W. S E cor. sec. 9	33	4	3	9 10 10	9 39 A	77 21 6	10 06 A	9·80005	"
" "	33	4	3	9 10 10	10.39 A	77 22 3	11 09 A	9·80006	"
5·00 N. 25·00 W N.E. cor. sec. 22	32	16	2	17 7 10	9 25 A	78 15·6	10.00 A	9 80178	"
" "	32	16	2	17 7–10	10 28 A	78 16 1	10 58 A	9 80098	"
" "	32	16	2	17 7 10	11 30 A	78 15 8	.....	.....	"
10 00 W Centre sec. 36	32	20	2	27 7 10	7 13 P	78 03·1	7 43 P	9 80143	"
30·00 W. N.E. cor. sec. 3	35	1	3	30 7–10	4.36 P	77 35·7	5 01 P	9 80312	"
" "	35	1	3	30– 7 10	5 31 P	77 33 0	5 58 P	9 80337	"
" "	35	1	3	30 7 10	6 36 P	77 33 4	.....	.....	"
At N.E. cor. sec. 8	26	12	2	6 7–10	2.15 P	77 53 1	2 47 P	9·80046	"
" "	26	12	2	6– 7 10	3.20 P	77 53 7	4.00 P	9·80029	"
" "	26	12	2	6– 7–10	4.30 P	77 54·3	.....	.....	"
3·00 E. of N. E. cor. sec. 22	33	22	2	16 7 10	1.30 P	78 01·0	2.02 P	9·80131	"
" "	33	22	2	16– 7 10	2 30 P	78 02·6	2.55 P	9·80082	"
" "	33	22	2	16 7–10	3.25 P	78 02·1	.....	.....	"
20·00 N.— N.E. cor sec. 17	36	27	Pr.	31 5 10	3.05 P	79 05·2	3 52 P	9 80566	"
" "	36	27	Pr.	31 5–10	4.47 P	79 04·7	.....	.....	"
" "	36	27	Pr.	1 6 10	9.25 A	79 10 8	10.17 A	9 80531	"

| | | |

TABLE No. 3—*Concluded.*

Place.	Tp.	Rge.	Mer.	Date.	Time.	Dip.	Time.	Total Intensity.	Observer.
						° ′			
" "	84	17	4	1- 6-10	9 30 A	79 27·3	10 21 A	9·79391	Carl Engler.
" "	84	17	4	1 6-10	11 06 A	79 26·8	. .	. .	"
Below Boiler Rapid, Athabaska River				5- 6-10	5.57 P	79 31·2	6 32 P	9·79874	"
Big Cascade, Athabaska R				7- 6-10	4 22 P	79 39·1	5 00 P	9·79499	J. A. Cote.
"				7- 6-10	5 32 P	79 42·9	. .	. .	"
Fort McMurray, S. Shore Athabaska R., opp. Island				10- 6-10	3 22 P	79 58·1	4 00 P	9·79727	"
" " "				10- 6-10	4 24 P	79 57·7	. .	. .	Carl Engler.
" " "				13- 6-10	2.11 P	80 00·1	3.00 P	9·79634	"
" " "				13- 6-10	3 39 P	79 58·1	. .	. .	"
Fort Chipewyan				17- 6-10	3 33 P	81 08·2	4.03 P	9·79649	J. A. Cote.
Smith Landing, S.W. cor. H. B. Co. Res.				23- 6-10	3 42 P	81 55·0	4 29 P	9·81617	"
" "				23- 6-10	4 54 P	81 19·4	. .	. .	Carl Engler.
Ft. Smith, near Observ. Tent				11- 7-10	4 20 P	81 57·3	5.05 P	9·79420	J. A. Cote.
" "				12- 7-10	3 27 P	81 57·9	4 16 P	9·79346	"
" "				12- 7-10	4 55 P	81 59·0	. .	. .	"
Fort Chipewyan				6- 8-10	10 43 A	81 09·7	12.24 P	9·79512	Carl Engler.
"				6- 8-10	1 20 P	81 09·2	. .	. .	"
Ft. McMurray, Point of Mag. Obs.				10- 8-10	9 19 A	80 02·8	10 09 A	9·79621	"
"				10- 8-10	10 49 A	80 00·1	. .	. .	"
Grand Rapids, E. shore of river				24- 8-10	10 15 A	79 28·5	10 52 A	9·79333	"
" "				24- 8-10	11 22 A	79 29·6	. .	. .	"

SESSIONAL PAPER No. 25b

TABLE No. 4.

Place.		Tp.	Rg.	Mer.	Date.	Declination.		Observer.
						1912.0		
At ¼ sec. cor. E. by sec.	36	19	1	Pr.	1910.4	12 28	12 33 4	P.R.A. Belanger.
11.00 N. N.E. cor. sec.	12	29	1	"	1910.5	12 [illegible]	12 57 6	E. W. Robinson.
63.00 N. "	12	29	1	"	1910.5	12 47.2	12 52 0	"
19.00 N. "	1	30	1	"	[illegible]	[illegible]	13 30 6	"
31.00 N. "	24	30	1	"	[illegible]	13 47.7	13 48.2	"
28.00 W. "	31	32	1	"	[illegible]	13 43 [illegible]	13 46 [illegible]	"
59.00 W. "	7	33	1	"	1910.8	13 [illegible]	13 43 [illegible]	"
19.00 N. "	36	33	1	"	1910.8	12 22.7	[illegible]	"
15.00 N. "	1	34	1	"	1910.8	13 [illegible]	[illegible]	"
20.00 N.— "	24	34	1	"	[illegible]	13 46.7	13 49 2	"
20.00 N. "	24	34	1	"	[illegible]	13 46.3	13 49 8	"
7.00 N. "	1	35	1	"	[illegible]	13 46.0	13 47 [illegible]	"
11.00 N. "	13	35	1	"	[illegible]	13 [illegible] 7	13 47.2	
1.52 N.— ¼ cor. E. by sec.	36	35	1	"	1911.2	14 [illegible] 6	14 47 7	A. W. Ponton
1.52 N. "	36	35	1	"	1911.2	14 [illegible]	14 52.0	"
26.88 N. "	24	35	1	"	1911.2	13 11.5	13 [illegible] 6	"
53.00 N. N.E. cor. sec.	36	37	1	"	1911.2	13 09	13 10.7	"
33.00 N.— "	36	37	1	"	1911.2	[illegible]	[illegible] 7	"
63.00 N.— "	36	37	1	"	1911.2	13 31 [illegible]	13 27.2	"
63.00 N.— "	36	37	1	"	1911.2	13 31 [illegible]	13 27.4	"
31.00 N. "	13	38	1	"	1911.2	11 41 2	11 45 3	"
31.00 N.— "	13	38	1	"	1911.2	[illegible]	11 43.5	"
30.00 N.— "	36	38	1	"	1911.2	13 08.7	13 12.8	"
57.00 N.— "	36	39	1	"	1911.2	12 [illegible]	[illegible]	"
57.00 N.— "	36	39	1	"	1911.2	12 [illegible]		"
23.00 N.— "	1	41	1	"	1911.2	12 51 5	12 54 6	"
23.00 N.— "	1	41	1	"	1911.2	12 49.3	12 52.4	"
1.00 N.— "	36	41	1	"	1911.2	12 41.4	12 44.5	"
59.00 N.— "	13	42	1	"	1911.2	12 52.7	[illegible]	"
59.00 N.— "	13	42	1	"	1911.2	12 55.8	12 57 9	"
56.00 N.— "	24	43	1	"	1911.2	13 16.9	13 13.0	"
14.00 N. "	12	44	1	"	1911.2	[illegible]	13 47.3	"
8.00 N. "	1	46	1	"	1911.2	14 03 8	14 03.9	"
11.00 N.—¼ cor. E. by	36	48	1	"	1911.3	13 05.2	13 09.6	"
11.00 N.—¼ "	36	48	1	"	1911.3	13 04 1	13 05 5	"
63.62 N. N.E. cor. sec.	13	51	1	"	[illegible]	13 15.9	13 17 1	"
49.40 N. "	36	51	1	"	[illegible]	13 42.3	13 42 5	"
45.00 N.— "	12	52	1	"	[illegible]	14 [illegible]	14 47 [illegible]	"
8.00 N.— "	36	52	1	"	1911.6	14 [illegible]	14 09 3	"
31.01 N. "	25	53	1	"	1911.6	13 31.0	13 29 9	"
38.27 N.— "	13	54	1	"	1911.6	13 38.9	13 37 4	"
34.75 N.— "	25	54	1	"	[illegible]	13 31.0	13 29.5	"
1.61 N.— "	12	[illegible]	1	"	[illegible]	13 44.6	13 42.1	"
47.63 N. "	12	[illegible]	1	"	[illegible]	[illegible]	13 36.2	"
24.00 N.— "	24	[illegible]	1	"	1911.6	13 16.1	13 [illegible]	"
[illegible] "	25	[illegible]	1	"	1911.6	13 50.7	13 51.2	"
[illegible] "	1	[illegible]	1	"	1911.6	13 37.1	13 33.6	"
[illegible] "	24	57	1	"	1911.7	[illegible]	[illegible] 11.9	"
[illegible] "	25	[illegible]	1	"	1911.7	[illegible]	[illegible]	"
53.77 N.— "	25	[illegible]	1	"	[illegible]	[illegible]	[illegible]	"
36.54 N.— "	12	[illegible]	1	"	1911.7	[illegible]	13 [illegible]	"
[illegible] "	25	[illegible]	1	"	1911.7	15 00.2	[illegible] 56.2	"
[illegible] "	25	[illegible]	1	"	[illegible]	14 25.2	14 25.2	"
At N.E. cor. sec.	1	15	2	"	1910.4	12 36.7		P.R.A. Belanger
"	14	24	2	"	[illegible]	12 58.7	[illegible]	
10.00 E.—N.E. cor. sec	33	[illegible]	2	"	[illegible]	13 31.4	13 34.9	E. W. Robinson.
18.00 W.— "	35	18	3	"	1910.4	[illegible]	13 49.2	P.R.A. [illegible]
[illegible] "	23	26	3	"	1909.9	13 21.4	[illegible] 26.4	
12.00 E.— "	31	32	2	"	1910.8	13 35.3	13 36.8	E. W. Robinson
[illegible] W. "	35	32	3	"	1910.8	12 47.1		
10.00 E.—¼ cor. N. by sec.	34	29	1	"	1910.4	13 42.8	13 43.9	P.R.A. Belanger.
40.00 S.—N.E. cor. sec.	33	27	4	"	[illegible]	13 29.8	13 36.8	
At N.E. cor. sec.	33	32	4	"	1910.8	13 36.1	13 36.6	E. W. Robinson.
¼ sec. cor. E. by sec.	13	21	5	"	1912.0	13 17.1	13 11.4	P. B. Street.
10.00 E.—N.E. cor. sec.	35	32	5	"	1910.7	14 03.9	[illegible] 7	E. W. Robinson.
At ¼ cor. E. by sec.	36	22	6	"	1910.5	13 27.7	13 29.5	P.R.A. Belanger.
30.00 S.—N.E. cor. sec.	11	23	6	"	[illegible]	[illegible]	12 42.9	P. B. Street.

TABLE No. 4—*Continued.*

Place.	Tp	Rge	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
At N.E. cor. sec. 22	26	6	Pr.	1909 9	14 16 9	14 19.5	P.R.A. Belanger.
8.00 W.—N.E. cor. sec. 33	32	6	"	1910.7	13 54 7	13 56.1	E. W. Robinson.
21.60 W.— " 36	32	6	"	1910.7	13 45 3		"
31.00 E.— " 32	32	6	"	1910.7	13 51 6	13 52 0	"
20 00 N. " 25	21	7	"	1910.5	13 20 8	13 24 6	P.R.A. Belanger.
At N.E. cor. sec. 22.	27	7	"	1909 9	13 32.6	13 46.2	"
28.00 S.—N.E. cor. sec. 20	32	7	"	1909.4	11 10 5	13 23 4	"
26.00 W.— " 32	16	8	"	1909.9	13 46 1	13 44 1	W. J. Deans.
At N.E. cor. sec. 30	16	8	"	1909.9	13 27 5	13 27 5	"
" " 30	16	8	"	1909.9	13 22 9	13 28 9	"
" " 30	16	8	"	1909.9	13 11 0	13 14 0	"
40.00 W.—N.E. cor. sec. 19	16	8	"	1909 9	14 18 9	14 17.9	"
41 00 W.— " 30	16	8	"	1909.9	13 05.9	13 07.9	"
At ¼ sec. cor. E. by sec. 26	22	8	"	1910.5	13 27.4	13 32 2	P.R.A. Belanger.
S.E. cor. sec. 4	26	8	"	1908.6	13 56 3	14 10 1	"
Centre E. by sec. 15	33	8	"	1912.0	14 10.0	14 04 3	"
11 50 N.—N.E. cor. sec. 17	6	9	"	1911.5	14 36 6	14 35 8	R. C. Purser.
41.00 W.—N.E. cor. sec. 31	16	9	"	1909 8	14 12 9	14 09 6	W. J. Deans.
41.00 W.— " 31	16	9	"	1909.8	14 25.8	14 22 5	"
At N.E. cor. sec. 21	16	9	"	1909.8	12 41 7	12 40 4	"
30.00 E.—N.E. cor. sec. 30	16	9	"	1909.8	14 08 8	14 13 5	"
20.00 E.— " 31	16	9	"	1909 8	14 05 4	14 12 1	"
20.00 E.— " 31	16	9	"	1909 7	14 12 4		"
20.00 E.— " 31	16	9	"	1909.7	14 04.3	14 13.3	"
20.00 E.— " 31	16	9	"	1909 8	14 16 4	14 12.1	"
At N.E. cor. sec. 33	16	9	"	1909.8	14 04 3	14 09 0	"
40.00 E.—N.E. cor. sec. 32	16	9	"	1909.8	14 01 8	14 07.0	"
40.00 E.— " 32	16	9	"	1909.8	13 56 1	13 58 8	"
40 00 E.— " 32	16	9	"	1909.8	13 57 0	13 53.7	"
At N.E. cor. sec. 29	16	9	"	1909.8	14 10 9	14 11 6	"
" " 29	16	9	"	1909 8	14 17 8	14 13 5	"
" " 30	16	9	"	1909.8	14 30 8	14 27 5	"
" " 30	16	9	"	1909 8	14 22 2	14 22 9	"
" " 30	16	9	"	1909 8	14 26 0	14 21 7	"
" " 30	16	9	"	1909 8	14 08.4	14 11 1	"
30.00 E.—N.E. cor. sec. 30	16	9	"	1909 8	14 11 1	14 13.8	"
At N.E. cor. sec. 7	16	9	"	1909.8	14 54 8	14 58 5	"
" " 19	16	9	"	1909.8	14 58.5	14 58 2	"
" " 19	16	9	"	1909.8	15 03 3	15 02 0	"
" " 31	16	9	"	1909.8	14 10.6	14 06 3	"
" " 32	16	9	"	1909.8	13 51 9	13 53 6	"
" " 3	16	9	"	1909.8	14 31 1	14 32 8	"
" " 32	16	9	"	1909.8	13 46 5	13 41 2	"
" " 31	16	9	"	1909.8	14 02.2	14 04 9	"
" " 7	16	9	"	1909.8	13 50 7	13 52 4	"
" " 5	16	9	"	1909.8	14 43.9	14 46 6	"
" " 3	16	9	"	1909.8	14 28.9	14 32 6	"
" " 32	16	9	"	1909 8	13 57.5	14 06 2	"
" " 32	16	9	"	1909.8	13 40 6	13 47 9	"
" " 33	16	9	"	1909 8	14 06 6	14 13 9	"
" " 20	16	9	"	1909.8	14 38 2	14 37 9	"
30.00 E.—N.E. cor. sec. 30	16	9	"	1909.8	14 18 0	14 14.7	"
30.00 E.— " 30	16	9	"	1909.8	14 17.8	14 21 1	"
20.00 E.— " 31	16	9	"	1909 7	14 17.7	14 23 7	"
20.00 E.— " 31	16	9	"	1909 7	14 09.8	14 06 8	"
At N.E. cor. sec. 11	30	9	"	1910 5	13 54 9	13 50 9	P.R.A. Belanger.
44.00 S.—N.E. cor. sec. 31	30	9	"	1909 4	15 03.0	15 01.1	"
10.60 E.— " 22	32	9	"	1912.0	13 14.0	13 09.3	"
62.00 N.— " 7	33	9	"	1912 0	13 47.9	13 43 2	"
At S.E. cor. sec. 6	15	10	"	1910 8	13 22.3		"
At N.E. " 24	16	10	"	1909.8	15 12.4	15 14.1	W. J. Deans.
" " 36	16	10	"	1909.8	14 40.3	14 37 0	"
" " 1	16	10	"	1909.8	15 51.5	15 48 2	"
" " 36	16	10	"	1909.8	14 41 4	14 50.1	"
40.00 W.—N.E. cor. sec. 36	16	10	"	1909.8	14 23.7	14 26 4	"
At N.E. cor. sec. 36	16	10	"	1909.8	14 36 0	14 38 7	"
" " 12	16	10	"	1909.8	11 59 5	12 00.2	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge	Mer.	Date.	Declination. Obsd.	Declination. Reduced to 1912.0	Observer.
At N.E. cor. sec. 36	16	10	Pr.	1909.8	14 36.0	14 38.7	W. J. Deans.
" " 23	17	10	"	1909.8	13 21.5	13 25.2	"
" " 34	17	10	"	1909.8	13 50.3	13 52.0	"
" " 24	17	10	"	1909.8	13 55.0	13 53.7	"
" " 23	17	10	"	1909.8	13 31.2	13 29.9	"
" " 25	17	10	"	1909.8	14 26.6	14 29.3	"
" " 25	17	10	"	1909.8	14 15.0	14 18.7	"
" " 24	17	10	"	1909.8	13 44.4	13 46.1	"
" " 7	18	10	"	1910.8	13 12.0	13 16.1	P.R.A. Belanger.
11.00 N.—N.E. cor. sec. 14	30	10	"	1909.5	14 19.9		
At N.E. cor. sec. 36	8	11	"	1910.8	12 50.8	12 49.9	"
3.00 E.—¼ sec. cor. sec. 33	22	11	"	1908.8	15 30.9	15 37.3	W. J. Deans
At N.E. cor. sec. 33	19	12	"	1909.5	14 41.7	14 40.9	"
" " 33	19	12	"	1909.5	14 33.4	14 40.6	
" " 33	19	12	"	1909.5	14 32.9	14 42.1	
" " 33	19	12	"	1909.5	14 57.7	14 55.9	"
" " 33	19	12	"	1909.5	14 31.7	14 48.9	"
41.00 W.—N.E. cor. sec. 31	19	12	"	1909.5	14 39.6	14 45.8	"
41.00 W.— " 31	19	12	"	1909.5	14 46.2	14 43.1	"
40.00 E.— " 29	20	12	"	1909.9	14 30.2	14 33.2	"
40.00 E.— " 29	20	12	"	1909.9	14 46.2	14 48.2	"
At N.E. cor. sec. 28	20	12	"	1909.9	14 34.6	14 37.6	"
" " 28	20	12	"	1909.9	14 47.8	14 49.8	"
" " 21	20	12	"	1909.9	14 41.9	14 41.9	"
50.00 E.—N.E. cor. sec. 17	20	12	"	1909.9	14 31.8	14 37.	"
50.00 E.— " 17	20	12	"	1909.9	14 45.1	14 49.9	"
At N.E. cor. sec. 21	20	12	"	1909.9	14 44.9	14 49.9	"
15.00 S.—N.E. cor. sec. 4	20	12	"	1909.6	14 35.4	14 41.3	"
At N.E. cor. sec. 28	20	12	"	1909.9	14 54.6	14 52.6	W. J. Deans.
40.00 E.—N.E. cor. sec. 29	20	12	"	1909.9	14 42.0	14 41.0	"
50.00 " " 17	20	12	"	1909.9	14 43.7	14 44.5	"
At N.E. cor. sec. 21	20	12	"	1909.9	14 48.9	14 49.9	"
" " 21	20	12	"	1909.9	14 43.7	14 44.7	"
" " 21	20	12	"	1909.9	14 58.2	15 05.2	"
15.00 S.—N.E. cor. sec. 4	20	12	"	1909.6	14 51.5	14 50.4	"
20.00 E. " 9	20	13	"	1909.6	14 52.6		"
25.00 W.— " 30	20	13	"	1909.6	15 02.5		"
20.00 E.— " 9	20	13	"	1909.6	14 38.7		"
20.00 E.— " 9	20	13	"	1909.6	14 49.3	14 47.4	"
20.00 E.— " 9	20	13	"	1909.6	14 39.8	14 52.9	"
4.00 S.—S.E. cor. sec. 14	27	13	"	1909.3	14 49.7	14 56.7	"
At N.E. cor. sec. 10	28	13	"	1909.3	15 00.4	15 09.6	"
18.42 W.—N.E. cor. sec. 36	28	14	"	1908.7	14 46.7	14 52.2	P. R. A. Belanger.
15.00 W.— " 32	17	15	"	1909.8	14 15.9		J. Francis.
At N.E. cor. sec. 32	17	15	"	1909.8	15 11.1		"
" " 22	18	15	"	1909.8	14 47.6	14 45.9	"
30.00 W.—N.E. cor. sec. 29	18	15	"	1909.9	14 36.7	14 42.7	"
20.00 W.— " 28	18	15	"	1909.9	14 53.5	14 51.5	"
32.00 W.— " 21	18	15	"	1909.8	14 39.7		"
4.00 W.— " 5	18	15	"	1909.8	14 40.4	14 42.1	"
35.00 W.— " 36	18	15	"	1909.8	14 25.5	14 32.8	"
0.50 E.— " 28	18	15	"	1909.8	14 41.5	14 48.8	"
7.00 S.— " 5	18	15	"	1909.8	14 42.5	14 47.2	"
15.00 E.— " 4	18	15	"	1909.8	15 03.8	15 02.5	"
21.00 N.— " 5	18	15	"	1909.8	14 51.7	14 55.4	"
25.00 S.— " 3	18	15	"	1909.8	15 05.1	15 15.1	"
66.00 S.— " 5	18	15	"	1909.8	14 25.2	14 23.9	"
3.00 S.— " 15	19	15	"	1909.9	14 09.2	14 07.2	"
34.00 W.— " 12	19	15	"	1909.9	14 21.7	14 28.7	"
At N.E. cor. sec. 11	30	15	"	1910.5	15 32.5	15 37.9	T. H. Plunkett.
" " 8	31	15	"	1909.6	15 09.3	15 17.4	P. R. A. Belanger.
" " 10	32	17	"	1909.6	16 07.8	16 07.9	"
" " 32	32	18	"	1909.6	16 40.0	16 43.1	"
45.00 N.—N.E. cor. sec. 9	32	18	"	1910.6	16 35.1	16 37.2	"
45.00 N.— " 9	32	18	"	1910.6	16 37.6	16 39.7	"
21.00 S.— " 25	1	20	"	1911.4	14 55.7	14 55.5	C. F. Aylsworth.
27.00 S.— " 8	18	20	"	1910.3	14 49.8	14 54.0	P. R. A. Belanger.

TABLE No. 1—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912·0.	
					° ′	° ′	
At N.E. cor. sec. 35	23	20	Pr.	1908.7	15 48.1	.....	W. J. Deans.
" " 36	24	20	"	1910.6	18 41.4	18 48.5	P. R. A. Belanger.
At S.E. " 1	35	20	"	1909.5	17 29.8	17 30.0	"
21.00 S.—N.E. cor. sec. 25	1	21	"	1911.4	14 53.1	.....	C. F. Aylsworth.
20.00 N.—S.E. " 26	1	21	"	1911.4	14 51.6	.....	"
20.00 S.—N.E. " 35	1	21	"	1911.4	14 55.3	14 58.1	"
65.00 S.— " 36	1	21	"	1911.4	14 56.1	14 57.9	"
At S.E. cor. sec. 7	20	21	"	1910.7	15 44.3	15 43.8	"
30.00 W.—N.E. cor. sec. 35	56	21	"	1911.1	17 56.4	.....	E. W. Robinson.
10.00 E.—¼ sec. cor. N. by 12	20	22	"	1910.3	16 26.3	16 29.5	P. R. A. Belanger.
At N.E. cor. sec. 11	20	22	"	1910.3	16 25.9	16 34.1	"
" " 31	56	22	"	1911.1	18 02.6	18 05.3	E. W. Robinson.
10.00 W.—N.E. cor. sec. 31	56	22	"	1911.1	18 07.4	18 13.1	"
20.00 N.— " 36	56	22	"	1911.1	18 02.2	.....	"
25.00 W.— " 31	56	24	"	1911.1	18 17.3	18 20.0	"
17.00 E.— " 35	56	24	"	1911.1	17 23.7	17 26.4	"
55.00 E.— " 34	56	24	"	1911.1	18 13.2	18 15.9	"
38.00 E.— " 35	56	25	"	1911.1	18 30.2	18 32.9	"
At N.E. cor. sec. 4	13	26	"	1909.5	17 48.1	17 56.7	O. Rolfson.
37.00 W.—N.E. cor. sec. 2	13	26	"	1909.4	17 57.9	18 04.8	"
37.00 W.— " 2	13	26	"	1909.5	17 53.1	17 57.3	"
30.00 W. " 31	56	26	"	1911.1	18 17.9	.....	E. W. Robinson.
At N.E. cor. sec. 35	56	26	"	1911.1	18 35.4	18 36.1	"
3.00 S.—N.E. cor. sec. 36	22	27	"	1908.5	14 38.8	14 47.3	W. J. Deans.
20.00 N.— " 17	36	27	"	1910.4	18 29.7	18 28.8	D. E. Chartrand.
20.00 N.— " 17	36	27	"	1910.4	18 29.5	18 29.6	"
20.00 N.— " 17	36	27	"	1910.4	18 26.2	18 30.3	"
20.00 N.— " 17	36	27	"	1910.4	18 24.1	18 28.2	"
20.00 N.— " 17	36	27	"	1910.4	18 21.0	18 30.6	"
20.00 N.— " 17	36	27	"	1910.4	18 17.0	18 25.1	"
20.00 N.— " 17	36	27	"	1910.4	18 37.1	18 33.2	"
20.00 N.— " 17	36	27	"	1910.4	18 30.0	18 30.1	"
20.00 N.— " 17	36	27	"	1910.4	18 27.4	18 31.5	"
20.00 N.— " 17	36	27	"	1910.4	18 24.2	18 32.3	"
20.00 N.— " 17	36	27	"	1910.4	18 21.5	18 30.6	"
20.00 N.— " 17	36	27	"	1910.4	18 17.9	18 27.0	"
20.00 N.— " 17	36	27	"	1910.4	18 19.5	18 28.6	"
20.00 N.— " 17	36	27	"	1910.4	18 19.8	18 27.9	"
20.00 N.— " 17	36	27	"	1910.4	18 21.6	18 27.7	"
20.00 N.— " 17	36	27	"	1910.4	18 24.2	18 28.3	"
20.00 N.— " 17	36	27	"	1910.4	18 26.3	18 29.6	"
20.00 N.—N.E. cor. sec. 17	36	27	"	1910.4	18 31.2	18 33.3	"
20.00 N.— " 17	36	27	"	1910.4	18 25.9	18 27.5	"
20.00 N.— " 17	36	27	"	1910.4	18 34.0	18 30.5	"
20.00 N.— " 17	36	27	"	1910.4	18 36.7	18 32.2	"
20.00 N.— " 17	36	27	"	1910.4	18 37.5	18 33.6	"
20.00 N.— " 17	36	27	"	1910.4	18 35.8	18 32.9	"
20.00 N.— " 17	36	27	"	1910.4	18 33.6	18 31.7	"
20.00 N.— " 17	36	27	"	1910.4	18 32.7	18 33.8	"
20.00 N.— " 17	36	27	"	1910.4	18 27.7	18 33.8	"
20.00 N.— " 17	36	27	"	1910.4	18 28.0	18 38.6	"
20.00 N.— " 17	36	27	"	1910.4	18 29.6	18 30.2	"
20.00 N.— " 17	36	27	"	1910.4	18 29.7	18 29.8	"
20.00 N.— " 17	36	27	"	1910.4	18 19.5	18 28.6	"
20.00 N.— " 17	36	27	"	1910.4	18 19.3	18 23.4	"
20.00 N.— " 17	36	27	"	1910.4	18 20.1	18 28.2	"
10.00 E.— " 35	56	27	"	1911.1	18 26.0	18 27.7	E. W. Robinson.
At N. E. cor. sec. 36	56	28	"	1911.1	18 43.4	18 44.1	"
15.21 E.—N. E. cor. sec. 23	25	29	"	1911.5	17 15.9	17 16.1	R. C. Purser.
At N. E. cor. sec. 12	25	29	"	1911.5	16 27.5	16 27.7	"
41.00 E.—N. E. cor. sec. 31	56	29	"	1911.1	18 40.2	.....	E. W. Robinson.
25.00 W.— " 33	56	29	"	1911.1	18 45.8	18 51.5	"
10.00 E.— " 35	56	29	"	1911.1	18 41.9	18 43.6	"
5.00 S.— " 17	25	30	"	1909.7	16 52.4	.....	J. Francis.
At N. E. cor. sec. 31	56	30	"	1911.0	18 42.1	18 45.1	E. W. Robinson.
40.14 S.—N. E. cor. sec. 29	8	31	"	1911.5	15 14.4	15 13.5	R. C. Purser.
10.00 N.—N. W. " 21	29	31	"	1911.9	19 43.5	19 39.0	C. Rinfret.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912·0	Observer.
					° ′ ″	° ′ ″	
At S. E. cor. sec. 31	30	31	Pr.	1910.4	17 19.2	17 17.3	C. F. Aylsworth.
At S. E. cor. sec. 31	30	31	"	1910.4	17 [illegible]	17 17.1	"
5.00 E.—N. E. cor. sec. 34	56	31	"	1911.0	19 20.0	19 22.0	E. W. Robinson.
4.00 S.— " 22	25	32	"	1909.6	18 21.8	18 17.9	J. Francis.
46.00 N.— " 16	25	32	"	1909.6	17 [illegible]	18 01.1	"
36.00 E.— " 15	25	32	"	1909.6	18 [illegible]	18 20.3	"
25.00 S.— " 19	25	32	"	1909.6	17 56.3	18 08.4	"
8.50 N.— " 30	25	32	"	1909.6	17 28.6	[illegible]	"
40.00 E.— " 6	25	32	"	1909.6	17 57.7	18 [illegible]	"
56.00 N.—S. E. " 32	25	32	"	1909.6	17 [illegible]	17 27.3	"
30.00 N.—N. E. " 6	25	32	"	1909.6	18 06.3	18 [illegible]	"
5.00 W.— " " 36	25	32	"	1909.6	16 [illegible]	16 55.5	"
At N. E. cor. sec. 35	25	32	"	1909.6	16 13.9	16 28.3	"
At N. E. cor. sec. 7	24	32	"	1909.6	18 07.6	18 05.8	"
30.00 N.—N. E. cor. sec. 14	24	32	"	1909.6	16 [illegible]	16 42.1	"
At N. E. cor. sec. 17	29	32	"	1909.6	17 47.5	17 47.2	"
45.00 W.—34.00 N—N. E. cor. 27	29	32	"	1909.6	16 38.4	16 59.0	"
10.00 S.—N. W. cor. fr. sec. 34	31	32	"	1909.6	[illegible]	[illegible]	"
45.00 S.— N. W.—cor. fr. sec. 3	32	32	"	1909.6	18 22.7	18 25.8	"
At N. E. cor. sec. 13	32	33		1911.9	19 24.1	19 19.7	C. Rinfret.
" 10	24	1	E. Pr.	1908.4	13 17.4	13 26.0	P.R.A. Belanger.
25.00 W.—S. E. cor. fr. tp. 27	27	1	"	1911.7	12 58.8	13 01.0	
20.00 W.—N. E. cor. sec. 33	28	1	"	1910.4	12 26.6	12 31.1	E. W. Robinson.
At N. E. cor. sec. 36	28	1	"	1910.4	12 28.1	12 35.6	"
10.00 W.—N. E. cor. sec. 31	28	2	"	1910.4	12 25.4	12 30.9	"
60.00 W.—N. E. cor. sec. 7	29	2	"	1911.7	11 45.4	11 39.4	P.R.A. Belanger.
At N. E. cor. sec. 18	29	2	"	1911.7	12 06.9	12 04.1	"
30.00 N.—S. E. cor. sec. 1	22	3	"	1910.7	12 11.8	12 13.8	"
30.00 W.—N. E. cor. sec. 31	28	3	"	1910.5	12 21.7	[illegible]	E. W. Robinson.
10.00 E.— " 32	28	3	"	1910.5	12 [illegible]	12 [illegible]	"
25.00 W.— " [illegible]	28	3	"	1910.5	12 [illegible]	12 25.8	"
10.00 E.— " 33	28	4	"	1910.5	12 13.4	12 15.2	"
10.00 W.— " [illegible]	28	4	"	1910.5	12 14.0	12 18.8	"
30.00 N.— " 24	13	5	"	1911.6	9 51.2	9 [illegible]	C. F. Aylsworth.
30.00 N.— " 24	13	5	"	1911.6	9 53.1	9 [illegible]	"
30.00 N.— " 24	13	5	"	1911.6	9 52.3	9 49.8	"
30.00 N.— " 24	13	5	"	1911.6	9 53.0	9 49.5	"
11.00 E.— " [illegible]	28	5	"	1910.5	12 [illegible]	12 06.8	E. W. Robinson.
12.00 N.—N. W. " 29	14	6	"	1911.3	13 06.8	13 10.9	C. F. Aylsworth.
12.00 N.— " " 29	14	6	"	1911.3	13 [illegible]	13 12.8	"
12.00 W.—S. E. cor. sec. 2	[illegible]	[illegible]	"	1911.8	13 30.3	13 28.3	"
12.00 W.— " [illegible]	15	6	"	1911.8	13 [illegible]	13 28.5	"
12.00 W.— " 2	[illegible]	6	"	1911.8	13 30.4	13 28.4	"
12.00 W.— " [illegible]	[illegible]	6	"	1911.8	13 30.4	13 27.4	"
At S. E. cor. sec. 3	[illegible]	6	"	1911.8	13 19.7	13 [illegible]	"
"	15	6	"	1911.8	13 19.5	13 05.5	"
42.00 W.—S. E. cor. sec. 3	15	6	"	[illegible]	13 21.4	13 [illegible]	"
12.00 W.— " 3	[illegible]	6	"	[illegible]	13 29.4	13 20.4	"
20.00 W.— " [illegible]	[illegible]	6	"	1911.8	13 17.3	13 12.3	"
20.00 W.— " [illegible]	[illegible]	6	"	1911.8	13 [illegible]	13 13.5	"
30.00 W.— " [illegible]	[illegible]	6	"	1911.8	12 45.6	12 [illegible]	"
30.00 W.— " [illegible]	15	6	"	1911.8	12 45.9	12 [illegible]	"
20.00 S.—N. E. cor. sec. 4	[illegible]	6	"	1911.8	13 22.1	13 18.1	"
20.00 S.— [illegible] 4	15	6	"	1911.8	13 [illegible]	13 17.7	"
40.00 S.— " 4	15	6	"	1911.8	13 [illegible]	13 14.5	"
[illegible] N. E. cor. sec. 4	15	6	"	1911.8	13 19.1	13 [illegible]	C. F. Aylsworth.
[illegible] N. W. " 5	15	6	"	1911.8	12 07.4	12 04.2	"
5.00 N.— " " 5	15	6	"	[illegible]	12 [illegible]	12 [illegible]	"
[illegible] W.—N. E. " 19	15	6	"	[illegible]	12 33.7	12 30.5	"
40.00 W.— " " 19	15	6	"	[illegible]	12 33.4	12 30.2	"
[illegible] N. W. " 30	15	6	"	1911.8	12 48.1	12 [illegible]	"
40.00 N.— " 30	15	6	"	[illegible]	12 47.7	12 42.5	"
[illegible] N. E. " 32	15	6	"	1911.9	12 34.5	12 [illegible]	"
[illegible] " " 32	[illegible]	6	"	1911.9	12 [illegible]	12 27.9	"
[illegible] " " 33	15	6	"	1911.9	12 58.2	12 54.7	"
[illegible] " " 33	15	6	"	1911.9	12 [illegible]	12 54.0	"
43.00 E.— " " 34	15	6	"	1911.9	12 [illegible]	12 35.3	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912 0	
					° ′ ″	° ′ ″	
9 00 W.—N.E. cor. sec. 29	16	7	E. Pr.	1910.7	12 10 7	12 11 7	P. R. A. Belanger
10 00 W.— " " 1	1	13	"	1910.0	9 30 1		"
6 00 S.—¼ sec. cor. E. by 17	11	13	"	1910 7	11 00 0	11 00 0	"
41 50 N.—N.E. cor. sec. 25	10	14	"	1909.8	11 32 2	11 39 5	"
At N.E. cor. sec. 6	11	14	"	1910.7	9 14 8	9 15 8	"
16 00 N.—N.E. cor. sec. 1	1	15	"	1908 5	9 31 1	9 40 6	"
At N.E. cor. sec. 24	1	15	"	1910 7	8 51 4		E. W. Hubbell.
At " " 24	10	15	"	1909.8	10 05 7	10 10 0	P. R. A. Belanger
At " " 6	2	16	"	1910 7	9 20 7	9 21 7	E. W. Hubbell.
30 00 S.—N.E. cor. sec. 36	3	16	"	1910 7	10 26 6	10 26 1	"
30 00 S.— " " 10	4	16	"	1910.7	10 22 8		"
20 00 N.— " " 3	5	16	"	1910 8	8 43 1		"
At N.E. cor. sec. 11	10	16	"	1909 8	10 46 0	10 49 7	P. R. A. Belanger
53 65 S.—N.E. cor. sec. 29	16	16	"	1911 3	9 10 3		"
1 77 S. — " " 15	16	16	"	1911 4	12 11 9	12 12 7	"
1 18 N.—N.E. cor. sec. 13	16	16	"	1911.4	10 13 6		"
At N.E. cor. sec. 31	2	17	"	1910.7	9 11 4	9 17 4	E. W. Hubbell.
At " " 7	4	17	"	1910 8	9 33 3		"
At " " 8	10	17	"	1909.8	8 28 0		P. R. A. Belanger
33 61 S.—N.E. cor. sec. 15	15	17	"	1911 6	10 44 6	10 37 1	"
71 06 S.— " " 9	16	17	"	1911 5	10 14 4	10 16 5	"
8 09 S. — " " 17	16	17	"	1911 5	8 42 2		"
30 00 N.—N.E. cor. sec. 24	56	1	2	1911.0	19 00 0	19 03 6	E. W. Robinson.
At N.E. cor. sec. 36	56	1	2	1911 0	19 18 6	19 21 6	"
7 00 E.—N.E. cor. sec. 35	56	1	2	1911.9	19 09 3	19 04 8	"
10 00 E.— " " 34	56	1	2	1911.9	19 21 3	19 16 8	"
36 09 N.— " " 12	57	1	2	1911.2	18 47 0	18 49 1	"
30 00 S.— " " 1	58	1	2	1911 2	19 07 1	19 08 2	"
50 00 N.— " " 12	58	1	2	1911.2	18 39 0	18 41 1	"
20 00 S.— " " 25	58	1	2	1911.2	19 11 2	19 13 3	"
45 00 N.— " " 1	59	1	2	1911.2	19 30 1	19 32 2	"
30 00 S.— " " 24	59	1	2	1911 2	19 34 9		"
10 00 S.— " " 36	59	1	2	1911 2	19 17 0	19 20 1	"
10 00 N.— " " 24	60	1	2	1911.2	19 51 8		"
17 00 N.— " " 13	61	1	2	1911.2	20 07 5	20 08 6	"
15 00 N.— " " 25	61	1	2	1911 2	20 03 0		"
8 72 N.— " " 12	62	1	2	1911 6	20 41 5	20 40 4	"
10 00 S.— " " 13	62	1	2	1911.6	29 43 6	29 46 5	"
0 00 N.— " " 24	62	1	2	1911 6	21 03 4	21 03 3	"
20 00 S.— " " 36	62	1	2	1911 6	20 57 5		"
10 00 N.— " " 1	63	1	2	1911.6	21 22 5	21 24 0	"
20 00 S.— " " 24	63	1	2	1911 6	21 20 9	21 17 4	"
5 00 S.— " " 1	64	1	2	1911 6	21 42 8	21 41 3	"
12 00 S.— " " 25	64	1	2	1911.7	20 35 3	20 29 5	"
35 00 N.— " " 13	65	1	2	1911 7	21 32 9	21 30 1	"
16 00 N.— " " 1	66	1	2	1911.7	22 33 0	22 28 0	"
30 00 N.— " " 13	67	1	2	1911.7	20 36 6	20 33 6	"
20 00 S.— " " 6	44	2	2	1910 4	18 41 4	18 45 3	E. W. Hubbell.
18 00 W.— " " 33	56	2	2	1911.9	19 17 6	19 13 2	E. W. Robinson.
16 00 N.— " " 14	10	3	2	1911.5	17 06 5	17 10 7	C. F. Aylsworth.
16 00 N.— " " 14	10	3	2	1911.5	17 07 4	17 11 6	"
16 00 N.— " " 14	10	3	2	1911 5	17 07 1	17 14 7	"
16 00 N.— " " 14	10	3	2	1911 5	17 08 5	17 13 6	"
16 00 N.— " " 14	10	3	2	1911.5	17 09 1	17 13 3	"
At ¼ cor. E. by sec. 17	21	3	2	1910.5	18 44 6	18 41 5	P. A. Carson.
Centre of sec. 16	21	3	2	1910.5	18 41 8	18 44 6	"
" " 16	21	3	2	1910 5	18 51 3	18 49 1	"
At N.E. cor. sec. 32	21	3	2	1910 5	18 17 0	18 24 4	"
At ¼ post E. by sec. 17	21	3	2	1910 5	18 47 4	18 44 8	"
" " 17	21	3	2	1910 5	18 46 0	18 42 9	"
" " 17	21	3	2	1910 5	18 29 0	18 37 9	"
" " 17	21	3	2	1010.5	18 28 8	18 37 2	"
" N.E. cor. sec. 21	44	3	2	1910.4	20 59 1	21 03 0	E. W. Hubbell.
60 00 N.—N.E. cor. sec. 8	45	3	2	1910.4	19 33 0	19 35 9	"
3 00 W.— " " 33	56	3	2	1911.9	18 25 4	18 23 0	E. W. Robinson.
40 00 S.— " " 9	21	4	2	1910 6	18 34 2	18 36 7	P. A. Carson.

SESSIONAL PAPER No. 25b

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Observed.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
40 00 S.—N.E. cor. sec. 9	21	4	2	1910.6	18 42.2	18 39.2	P. A. Carson.
At N.E. cor. sec. 16	21	4	2	1910.6	18 36.0	18 42.5	"
At ¼ cor. E. by sec. 9	21	4	2	1910.6	18 44.1	18 39.9	"
At ¼ cor. E. by sec. 9	21	4	2	1910.6	18 26.1	18 34.9	"
15 00 E.—N.E. cor. sec. 26	24	4	2	1909.7	18 26.3	18 21.3	J. Francis.
30 00 S.—	24	4	2	1909.7	18 17.2	18 21.0	"
At N.E. cor. sec. 34	24	4	2	1909.7	18 19.5	18 20.5	"
" " 21	24	4	2	1909.7	18 05.2	18 04.2	"
20 00 W.—N.E. cor. sec. 32	24	4	2	1909.7	18 19.0	18 26.0	"
30 00 W.—20 00 N.—S.E. " " 3	21	4	2	1909.7	17 56.2	18 03.2	"
45 24 E.—N.W. " " 2	25	4	2	1909.4	17 32.8	17 37.7	"
5 00 W.—N.E. cor. "	11	4	2	1910.4	17 41.5	17 45.4	E. W. Hubbell.
5 00 E.— " "	55	4	2	1911.9	19 55.8	19 49.4	E. W. Robinson.
10 00 E.— " "	56	4	2	1911.9	20 18.8	..	"
2 00 W.— " "	11	5	2	1909.5	17 16.6	17 20.8	O. Rolfson.
10 00 E.— " "	11	5	2	1909.6	17 41.2	17 47.3	"
40 00 S.— " "	12	5	2	1909.6	17 14.2	17 18.3	"
60 35 S.— " "	12	5	2	1909.6	17 34.0	17 41.9	"
5 00 S.—S.E. cor. sec. 8	12	5	2	1909.6	17 20.9	17 18.0	"
54 00 S.—N.E. " " 5	12	5	2	1909.6	17 28.1	17 35.2	"
40 00 E. " " 8	12	5	2	1909.6	17 16.6	17 26.7	"
1 00 E.—S.E. cor. sec. 4	12	5	2	1909.6	17 45.8		"
40 00 S.—N.E. " sec. 1	27	5	2	1909.4	18 54.2	19 01.1	J. Francis.
At S.E. cor. sec. 3	28	5	2	1910.6	18 49.4		C. P. Anderson.
At N.E. cor. sec. 8	40	5	2	1911.8	18 32.9	18 26.7	P. R. A. Belanger
2 00 N.—N.E. cor. sec. 8	40	5	2	1911.8	18 18.3	18 15.1	"
29 05 N. " " 20	44	5	2	1910.4	19 48.5	19 52.9	E. W. Hubbell
11 00 W.— " " 34	56	5	2	1911.9	20 28.2	20 25.8	E. W. Robinson.
20 00 W. " " 35	56	6	2	1912.0	20 17.7	20 14.0	"
23 00 W. " " 33	56	6	2	1912.0	20 33.4	20 29.7	"
17 00 W. " " 32	56	6	2	1912.0	21 02.7	20 57.0	"
5. 00 N.—S.E. cor. sec. 16	11	7	2	1909.8	18 46.7	18 49.4	O. Rolfson
At N.W. cor. sec. 31	11	7	2	1909.8	18 55.3	18 57.0	"
At S.E. cor. sec. 4	14	7	2	1911.8	19 32.5	19 33.2	"
" " 6	23	7	2	1910.4	18 27.4	18 29.5	D. E. Chartrand.
" " 6	23	7	2	1910.4	18 15.7	18 17.8	"
64.50 W.—N.E. cor. sec. 22	40	7	2	1911.8	20 03.3	19 58.1	P.R.A. Belanger.
At N.E. cor. sec. 7	42	7	2	1910.3	20 06.2	20 11.4	E. W. Hubbell.
" " 35	56	7	2	1912.0	21 05.7	20 59.0	E. W. Robinson.
" " 35	56	7	2	1909.7	17 56.8	18 01.8	O. Rolfson.
" " 8	37	8	2	1909.8	21 55.5	21 54.2	E. W. Hubbell.
10 00 S.—N.E. cor. sec. 8	37	8	2	1909.8	21 57.7		"
77 00 S.— " " 1	7	8	2	1909.1	21 21.2	21 26.6	"
12 00 E.—N.W. " " 21	41	8	2	1910.3	20 23.4	20 27.6	"
At S.E. cor. sec. 1	43	8	2	1910.3	20 26.7	20 31.9	"
At N.E. cor. sec. 24	44	8	2	1911.0	20 54.4	20 57.3	"
" " 36	56	8	2	1912.0	20 11.2	20 04.5	E. W. Robinson.
At S.E. cor. sec. 5	15	9	2	1909.8	18 34.6	18 38.9	O. Rolfson.
5 00 N.—N.E. cor. sec. 18	21	10	2	1911.9	19 50.3	19 47.8	P.R.A. Belanger.
3 74 N. " " 25	42	10	2	1910.3	20 32.4	20 41.6	E. W. Hubbell.
20 00 S.— " " 34	44	10	2	1911.0	20 29.2	20 28.1	"
40 00 W. " " 36	9	11	2	1911.4	20 14.3	20 21.1	G. A. Bennett.
At ¼ cor. E. By. sec. 29	23	11	2	1910.5	18 46.6	18 43.0	P. A. Carson.
" " " 29	23	11	2	1910.5	18 41.6	18 44.0	"
At N.E. cor. sec. 35	45	11	2	1911.8	21 22.3	21 15.3	P. R. A. Belanger
10 00 W.—N.E. cor. sec. 33	45	11	2	1911.8	19 36.6	19 34.6	"
40 00 N.—N.E. cor. sec. 1	47	11	2	1911.8	21 19.4		"
40.00 W.—S.E. cor. sec. 2	47	11	2	1911.8	20 28.7	20 24.7	"
At centre—E. By. sec. 23	49	11	2	1911.9	19 16.1	19 07.6	"
" " " 24	50	11	2	1911.9	18 50.7	18 46.2	"
33 00 W.—S.W. cor. sec. 2	51	11	2	1911.9	18 31.5	18 28.0	"
50.00 S.—N.E. cor. sec. 32	1	12	2	1909.7	18 13.0	18 11.8	O. Rolfson.
41 00 E.— " " 32	1	12	2	1909.7	18 05.3	18 18.1	"
50 00 S.— " " 4	1	12	2	1909.7	18 03.2	18 08.2	"
At N.E. cor. sec. 12	1	12	2	1909.7	18 23.5	18 20.5	"
At S.E. cor. sec. 3	1	12	2	1909.7	18 00.5	18 10.5	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
6.00 S.—N.W. cor. sec. 36	2	12	2	1909.7	18 06.3	18 17.3	O. Rolfson.
At S.E. cor. sec. 4	2	12	2	1909.7	18 19.9	18 15.9	"
16.09 N.—S.W. cor. sec. 6	2	12	2	1909.7	18 14.8	18 12.8	"
10.00 S.—N.E. cor. sec. 12	2	12	2	1909.7	18 18.1	18 26.4	"
At S.E. cor. sec. 6	2	12	2	1909.7	18 33.4	18 31.4	"
At N.E. cor. sec. 24	2	12	2	1909.7	18 21.6	18 29.6	"
At S.E. cor. sec. 6	2	12	2	1910.7	18 13.7	18 14.2	C. F. Aylsworth.
15.00 S. of ¼ post E. by sec. 8	26	12	2	1910.5	19 24.3	19 25.7	P. A. Carson.
15.00 " " " 8	26	12	2	1910.5	19 27.1	19 28.5	"
15.00 " " " 8	26	12	2	1910.5	19 25.4	19 23.8	"
15.00 " " " 8	26	12	2	1910.5	19 23.2	19 25.6	"
15.00 " " " 8	26	12	2	1910.5	19 27.7	19 27.1	"
15.00 " " " 8	26	12	2	1910.5	19 27.1	19 25.5	"
15.00 " " " 8	26	12	2	1910.5	19 25.1	19 27.5	"
15.00 " " " 8	26	12	2	1910.5	19 21.6	19 24.0	"
15.00 " " " 8	26	12	2	1910.5	19 17.5	19 22.9	"
15.00 " " " 8	26	12	2	1910.5	19 14.4	19 23.3	"
15.00 S. of ¼ post E. by sec. 8	26	12	2	1910.5	19 11.6	19 18.1	"
15.00 S. " " 8	26	12	2	1910.5	19 08.5	19 15.9	"
15.00 S. " " 8	26	12	2	1910.5	19 08.9	19 16.3	"
15.00 S. " " 8	26	12	2	1910.5	19 10.1	19 18.0	"
15.00 S. " " 8	26	12	2	1910.5	19 13.2	19 20.1	"
15.00 S. " " 8	26	12	2	1910.5	19 16.4	19 21.8	"
15.00 S. " " 8	26	12	2	1910.5	19 17.5	19 21.4	"
15.00 S. " " 8	26	12	2	1910.5	19 19.3	19 22.7	"
15.00 S. " " 8	26	12	2	1910.5	19 16.6	19 20.0	"
60.00 W.—N. E. cor. sec. 9	44	12	2	1909.8	18 30.9	18 28.6	E. W. Hubbell.
At N. E. cor. sec. 33	47	12	2	1909.7	18 59.5	18 58.5	"
" " 20	49	12	2	1909.7	19 25.0	19 31.0	"
42.00 E.—S. E. cor. sec. 5	3	13	2	1909.7	18 07.3	18 09.3	O. Rolfson.
At N. E. cor. sec 24	42	13	2	1909.8	17 57.0	17 49.7	E. W. Hubbell
" " 36	50	13	2	1909.8	20 04.5	20 02.2	"
20.00 N.—N. E. cor. sec. 2	52	13	2	1909.8	23 29.6	23 21.3	"
10.00 E.—S. E. " 5	3	14	2	1909.7	18 08.7	18 14.5	O. Rolfson.
15.00 S.—N. E. " 30	27	14	2	1910.5	19 15.2	19 11.6	P. A. Carson.
11.00 E.—¼ cor. S. by 29	27	14	2	1910.5	19 01.3	19 07.2	"
67.45 N.—N. E. cor. sec. 12	42	14	2	1910.4	19 25.2	19 25.1	E. W. Hubbell.
At N. E. cor. sec. 16	50	14	2	1909.7	23 16.0	23 20.0	"
15.00 S.—N. E. cor. sec. 8	8	15	2	1911.6	21 02.6	.....	G. A. Bennett.
25.00 S.— " " 3	18	15	2	1909.8	15 05.4	.....	J. Francis.
At ¼ cor. E. by sec. 36	27	15	2	1910.5	19 05.4	19 00.8	P. A. Carson
" " " 25	27	15	2	1910.5	19 02.0	19 03.4	"
At S. E. cor. sec. 25	27	15	2	1910.5	19 06.5	19 02.9	"
5.00 E.—N. E. cor. sec. 21	17	16	2	1911.5	19 02.9	19 03.0	C. Rinfret.
At N. E. cor. sec. 21	17	17	2	1911.5	18 53.3	18 53.4	"
" " 10	19	17	2	1911.5	18 30.2	18 29.4	"
" " 10	19	17	2	1911.5	18 38.5	18 31.7	"
" " 10	19	17	2	1911.5	18 30.8	18 34.0	"
20.00 S.—¼ E. by sec. 10	31	17	2	1910.5	19 28.7	19 31.7	D. E. Chartrand.
At N. E. cor. sec. 22	17	18	2	1911.5	18 46.9	18 48.0	C. Rinfret.
" " 15	34	18	2	1910.6	19 46.8	19 48.9	P. A. Carson.
" " 15	34	18	2	1910.6	19 48.6	19 50.7	"
Lac la Rouge	71	19	2	1909.6	24 27.1	24 31.2	L. R. Ord.
"	71	19	2	1909.7	24 14.4	.....	"
"	71	19	2	1909.7	23 46.4	23 50.4	"
"	71	19	2	1909.5	24 56.2	25 04.8	"
"	71	19	2	1909.5	24 49.0	24 56.2	"
"	71	19	2	1909.6	24 09.2	24 07.1	"
"	71	19	2	1909.6	20 23.4	20 27.5	"
"	71	19	2	1909.6	26 15.8	26 21.9	"
"	71	19	2	1909.6	22 50.8	22 57.7	"
"	71	19	2	1909.6	24 28.2	24 34.1	"
30.00 W.—N. E. cor. sec. 13	42	21	2	1910.8	19 37.4	19 39.5	D. E. Chartrand.
5.00 S. 10.00 E. ¼ cor. E. by 29	45	21	2	1910.7	20 28.2	20 21.2	P. A. Carson.

TABLE No. 1—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
5.00 S. 10.00 E. ¼ cor. E. by 29 ...	45	21	2	1910.7	20 25.7	20 18.7	P. A. Carson.
5.00 S. 10.00 " 29	45	21	2	1910.7	20 24.1	20 17.1	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 24.5	20 18.5	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 25.7	20 19.7	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 22.0	20 21.5	"
5.00 S. 10.00 " 29.....	45	21	2	1910.7	20 18.6	20 20.6	"
5.00 S. 10.00 " 29.....	45	21	2	1910.7	20 15.6	20 24.4	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 14.4	20 20.9	"
5.00 S. 10.00 " 29 ..	45	21	2	1910.7	20 17.3	20 17.8	"
5.00 S. 10.00 " 29 ...	45	21	2	1910.7	20 13.0	20 16.5	"
5.00 S. 10.00 " 29.....	45	21	2	1910.7	20 12.8	20 16.3	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 19.4	20 11.4	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 13.4	20 17.4	"
5.00 S. 10.00 " 29	45	21	2	1910.7	20 15.0	20 17.0	"
5.00 S. 10.00 " 29.....	45	21	2	1910.7	20 24.0		"
5.00 S. 10.00 " 29.....	45	21	2	1910.7	20 19.5	20 19.3	"
At N. E. cor. sec. 35.....	45	21	2	1908.7	21 14.5	21 20.9	W. R. Reilly
15.00 E.—N. E. cor. sec. 31..	46	21	2	1908.7	20 58.8	21 05.3	"
2.00 N.—N. E. cor. sec. 11..	48	21	2	1910.5	21 24.9	21 27.7	E. W. Hubbell.
60.00 S.— " 31.....	49	21	2	1909.4	21 18.3	21 26.2	W. R. Reilly.
30.00 S.— " 19..	49	21	2	1909.4	20 59.6	21 05.3	"
20.00 S.— " 19..	49	21	2	1909.4	21 12.3	21 13.0	"
20.00 S.— " 30..	49	21	2	1909.4	21 15.7	21 21.4	"
20.00 E.—S. W. " 28.....	49	21	2	1909.4	21 00.6	21 03.5	"
20.00 S.—N. E. " 33..	49	21	2	1909.4	20 46.8	20 55.7	"
10.00 S.—N. E. " 23..	49	21	2	1909.4	21 02.1	21 07.0	"
60.00 E. S. W. " 27.....	49	21	2	1909.4	20 43.9	20 53.8	"
60.00 S.—N. E. " 34..	49	21	2	1909.4	21 18.4	21 21.3	"
30.00 S.—N. E. " 14.	49	21	2	1909.4	21 11.1	21 22.9	"
50.00 S.—N. E. " 5	49	21	2	1909.4	21 43.1	21 44.9	"
30.00 W.—S. E. " 17	49	21	2	1909.4	20 55.3	20 56.2	"
20.00 S.—N. E. " 27	49	21	2	1909.4	21 05.7	21 13.6	"
50.00 S.—N. E. " 22.....	49	21	2	1909.4	21 21.7	21 24.6	"
30.00 E.—S. W. " 18	49	21	2	1909.4	20 57.6	21 08.9	"
30.00 W.—N.E. " 29	49	21	2	1909.4	21 14.0	21 19.9	W. R. Reilly.
20.00 S.— " 19	49	21	2	1909.4	21 13.3	21 22.2	"
30.00 S.— " 20.....	49	21	2	1909.4	20 51.9	21 00.8	"
60.00 S.— "	49	21	2	1909.4	20 58.7	21 01.6	"
Sec. 6 Tra[illegible] of Land Mea[illegible] Lake	8	22	2	1910.6	20 09.6	20 02.1	P. A. Carson.
At ¼ cor. W. by [illegible]	45	22	2	1910.7	20 01.6		"
" 31.....	45	22	2	1910.7	20 08.5	20 05.3	"
At N.E. cor. sec. 33.....	46	22	2	1909.7	21 [illegible]	21 17.3	W. R. Reilly.
At S.E. cor. sec. 4.....	15	23	2	1911.5	19 36.4	19 38.6	C. Rinfret.
At N.E. cor. sec. 34.....	15	23	2	1911.5	19 28.1	19 31.1	"
5.50 W.—N.E. cor. sec. 25	38	23	2	1909.6	19 57.9	20 04.0	P. A. Carson
At N.E. cor. sec. 31.....	16	24	2	1911.4	19 20.9	19 20.7	C. Rinfret.
10.00 N.—N.E. cor. sec. 4.....	17A	24	2	1909.9	21 30.7	21 35.8	W. R. Reilly.
70.00 S.— " 31.....	17	24	2	1909.6	22 11.1	22 10.5	C. F. Miles.
40.00 W. [illegible] 8	6	24	2	1911.2	[illegible]		A. Saint Cyr.
N.E. cor. sec. 35.....	12	25	2	1911.8	22 15.2	22 11.2	E. W. Hubbell
At N.E. cor. sec. 21.....	15	26	2	1911.6	19 20.0		C. Rinfret.
" " 20.....	16	26	2	1911.6	19 [illegible]	20 00.3	"
3.00 N.—N.E. cor. sec. 36.....	58	26	2	1911.8	22 37.4	22 [illegible]	E. W. Hubbell.
40.00 N. [illegible] 6	58	27	2	1911.1	23 30.6	23 [illegible]	A. Saint Cyr.
At N.E. cor. sec. 28.	58	27	2	1911.1	22 52.0		"
5.00 S.—N.E. cor. sec. 32.....	15	27	2	1911.4	19 57.8	20 01.2	C. F. Miles.
30.00 S.— " 17.....	15	27	2	1911.4	19 24.4	19 27.[illegible]	"
75.61 W.— " 36	15	27	2	1911.5	21 43.9	21 44.[illegible]	E. W. Hubbell.
At N.E. cor. 27.....	45	27	2	1911.5	22 15.7	22 15.[illegible]	"
30.00 S.—N.E. cor. sec. 21.....	45	27	2	1909.7	23 03.5	23 [illegible].5	W. R. Reilly.
65.00 N.— " 17..	45	27	2	1909.7	23 22.2	23 23.7	"
20.00 W.— " 17.....	45	27	2	1909.7	23 24.8	23 28.6	"
10.00 W.— " 22.....	45	27	2	1909.8	23 06.4	23 05.1	"
30.00 S.— " 14.....	45	27	2	1909.8	23 04.9	23 09.6	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Observed.	Reduced to 1912.0	
					° ′	°	
14.00 E.—N.E. cor. sec. 15	45	27	2	1909.8	23 08.0	23 08.7	W. R. Reilly.
60.00 S.— " 23	45	27	2	1909.8	23 08.7		
45.00 S.— " 31	48	27	2	1910.6	22 49.8	22 50.9	C. F. Miles.
6.00 S.— " 8	49	27	2	1910.6	23 30.5	23 31.6	E. W. Hubbell.
15.00 E.— " 12	15	28	2	1911.4	19 28.2	19 30.6	C. F. Miles.
40.00 W.— " 14	45	28	2	1909.7	24 39.2	24 43.0	W. R. Reilly.
40.00 S.— " 14	45	28	2	1909.6	24 29.7	24 35.8	"
76.00 W.— " 19	36	1	3	1909.6	22 50.6	23 00.7	"
At S.E. cor. sec. 6	36	1	3	1909.6	21 53.6	21 59.7	"
8.00 E.—N.E. cor. sec. 22	36	1	3	1909.6	22 06.7	22 04.8	"
60.00 W.— " 12	36	1	3	1909.6	22 20.0	22 20.1	"
40.00 W.— " 7	36	1	3	1909.6	22 14.6	22 14.7	"
16.00 S.— " 9	36	1	3	1909.6	22 19.3	22 19.2	"
8.00 N.— " 12	36	1	3	1909.6	22 30.3	22 46.2	"
24.00 S.— " 12	36	1	3	1909.6	22 17.9	22 28.3	"
24.00 S.— " 14	36	1	3	1909.6	22 32.7	22 34.1	"
12.00 N.— " 10	41	1	3	1909.5	20 51.3	21 03.5	"
26.00 S.— " 27	41	1	3	1909.5	20 43.5		"
50.00 S.— " 27	41	1	3	1909.5	21 07.6	21 02.8	"
70.00 S.— " 9	41	1	3	1909.5	21 08.1	21 15.3	"
10.00 S.— " 20	41	1	3	1909.5	21 41.3	21 50.5	"
30.00 S.— " 31	41	1	3	1909.5	21 16.3	21 16.5	"
30.00 S.— " 20	41	1	3	1909.5	21 21.1	21 28.3	"
At N.E. cor. sec. 9	41	1	3	1909.6	20 51.8	20 58.2	"
20.00 W.—N.E. cor. sec. 20	41	1	3	1909.6	21 32.8	21 41.7	"
8.00 E.— " 21	41	1	3	1909.6	20 55.2	20 54.1	"
6.00 E.— " 28	41	1	3	1909.6	21 05.3	21 10.2	"
64.00 S.— " 4	42A	1	3	1909.5	21 26.0	21 37.2	"
34.00 S.— " 10	42A	1	3	1909.5	21 22.9	21 22.1	"
20.00 W.— " 16	42A	1	3	1909.5	22 07.3	22 14.5	"
At N.E. cor. sec. 24	45	1	3	1909.6	25 31.7	25 37.8	"
77.00 S.—N.E. cor. sec. 1	53	1	3	1910.0	22 50.2	22 52.5	A. Saint Cyr.
9.00 S.— " 1	56	1	3	1909.1	22 27.9	22 37.3	"
2.88 E.—N.W. cor. sec. 34	56	1	3	1909.8	23 09.7	23 12.4	Wm. Christie.
7.15 E.— " 33	56	1	3	1909.8	22 59.1	22 56.8	"
" " 33	56	1	3	1909.8	22 51.9	22 59.6	"
23.00 N.—N.E. cor. sec. 25	59	1	3	1910.4	23 55.4	23 59.3	A. Saint Cyr.
" " 25	59	1	3	1910.4	23 55.9	23 53.8	"
" " 25	59	1	3	1910.4	23 38.8	23 46.7	"
" " 25	59	1	3	1910.4	23 39.6	23 44.5	"
" " 25	59	1	3	1910.4	22 55.3	22 59.2	"
" " 25	59	1	3	1910.4	23 53.8	23 52.7	"
" " 25	59	1	3	1910.4	23 37.0	23 45.9	"
" " 25	59	1	3	1910.4	23 40.3		"
40.00 N.—N.E. cor. sec. 34	59	1	3	1910.4	25 27.1	25 24.2	"
" " 34	59	1	3	1910.4	25 08.6	25 16.7	"
55.00 N.— " 13	60	1	3	1909.2	22 43.1		"
75.00 N.— " 12	61	1	3	1910.5	23 34.9	23 38.7	"
10.00 N.— " 36	62	1	3	1910.5	25 29.4	25 32.8	"
40.00 N.— " 25	63	1	3	1910.6	24 32.4	24 34.5	"
40.00 N.—N.E. cor. sec. 21	64	1	3	1910.6	25 04.1	25 03.2	A. Saint Cyr.
At N.E. cor. sec. 24	64	1	3	1910.6	24 54.4	24 57.5	"
41.00 E.—N.E. cor. sec. 31	36	2	3	1911.6	21 55.9		R. C. Purser.
1.50 N.— " " 19	43	2	3	1911.6	23 47.4	23 43.3	"
20.56 E.—N.W. " 35	56	2	3	1909.7	24 08.9		Wm. Christie.
60.34 E.— " " 31	56	2	3	1909.7	23 52.1		"
47.48 E.— " " 35	56	2	3	1909.7	23 56.9		"
13.00 W.—N.E. " 33	60	2	3	1909.4	23 16.0	23 23.7	A. Saint Cyr.
30.00 W.— " " 32	64	2	3	1910.6	24 32.9	24 33.0	"
19.00 S. 3.00 W.—N.E. cor. sec. 34	42	3	3	1910.8	25 19.5	25 15.2	D. E. Chartrand.
19.00 S. 3.00 W.— " 34	42	3	3	1910.8	25 12.2	25 13.9	"
19.00 S. 3.00 W.— " 34	42	3	3	1910.8	25 18.4	25 14.1	"
19.00 S. 3.00 W.— " 34	42	3	3	1910.8	25 11.5	25 14.2	"
19.00 S. 3.00 W.— " 34	42	3	3	1910.8	25 17.7	25 14.4	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′ ″	° ′ ″	
19.60 S. 3 00 W.—N.E. cor, sec. 34..	42	3	3	1910.8	25 08·3	25 11·0	D. E. Chartrand.
19.00 S. 3 00 W.— " 34.	42	3	3	1910 8	25 22·2	25 15·9	"
19 00 S. 3.00 W. " 34..	42	3	3	1910.8	25 05·1	25 05 8	"
19.00 S. 3 00 W.— " 34.	42	3	3	1910.8	25 15 9	25 11 6	"
19.00 S 3.00 W.— " 34..	42	3	3	1910 8	25 09 3	25 11·0	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.8	25 18 4	25 14·1	"
19 00 S. 3 00 W.— " 34..	42	3	3	1910 8	25 08 0	25 12·2	"
19 00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 16 2	25 11·6	"
19.00 S. 3 00 W. " 34..	42	3	3	1910 9	25 07 6	25 08·0	"
19.00 S. 3.00 W.— " 34..	42	3	3	1910 9	25 14 2	25 09 6	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 08 3	25 10·7	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910 9	25 16 6	25 12·4	"
19.00 S. 3 00 W. " 34..	42	3	3	1910.9	25 06 6	25 06·4	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 14 9	25 11·3	"
19.00 S. 3 00 W. " 34..	42	3	3	1910 9	25 04 3	25 06·2	"
19 00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 15 8	25 14·2	"
19 00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 07 8	25 09·2	"
19 00 S. 3 00 W.— " 34.	42	3	3	1910.9	25 13 7	25 09·1	"
19.00 S. 3 00 W. " 34..	42	3	3	1910.9	25 07 5	25 08 9	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 15 [illegible]	25 10·7	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 04 5	25 07 9	"
19.00 S. 3 00 W. " 34..	42	3	3	1910 9	25 14 6	25 10 0	"
19.00 S. 3 00 W. " 34..	42	3	3	1910 9	25 03 2	25 07·6	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 15 9	25 10·3	"
19 00 S. 3 00 W.— " 34 .	42	3	3	1910.9	25 03 1	25 06·0	"
19.00 S. 3 00 W. " 34..	42	3	3	1910.9	25 17 8	25 19·2	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 08 6	25 10·0	"
19.00 S. 3 00 W. " 34..	42	3	3	1910.9	25 12 9	25 11 3	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 00 1	25 05·8	"
19.00 S. 3 00 W.— " 34..	42	3	3	19.0.9	25 17 9	25 17 3	"
19.00 S. 3 00 W.— " 34..	42	3	3	1910.9	25 04 0	25 04·4	"
30.00 S. 5 00 E.— " 34..	42	3	3	1910 6	25 18 1	25 08·4	P. A. Carson.
30.00 S. 5 00 E.— " 34..	42	3	3	1910.6	24 56 4	24 59·7	"
At S.E. cor. sec. 1	43	3	3	1910 6	24 41 3	24 43·4	"
" 1	43	3	3	1910.6	24 40 3	24 37 4	"
15.00 W.—N.E. cor. sec. 9....	47	3	3	1909 5	25 07 8	25 14·0	A. L. McNaughton
2 00 N. " 9	47	3	3	1909 5	25 04 6	25 11·2	
At N.E. cor. sec. 11.	48	3	3	1909.8	24 23·8	24 31·5	W. R. Reilly.
" 23.....	48	3	3	1909 7	24 47 2	24 53·2	"
38.00 S.—N.E. cor. sec. 14.....	48	3	3	1909.8	24 42 3	24 39·2	"
12.00 E.— " 11	48	3	3	1909 8	24 34 2	24 40 9	"
18.00 S.— " 12	48	3	3	1909 8	24 33 7	24 40 4	"
54 00 S. " 7	48	3	3	1909.8	24 39 4	24 41·1	"
75.00 S.— " 10	48	3	3	1909.7	24 59 7	25 05 7	"
45.00 S.— " 27	48	3	3	1909 7	24 51 7	24 52·7	"
66 00 S. " 22	48	3	3	1909.7	24 51 2	24 59·2	"
At N.E. cor. sec. 10.....	48	3	3	1909.7	24 57 9	24 58 9	"
48 00 W.—N.E. cor. sec. 34	48	3	3	1909.7	24 08 2	24 09·9	"
56 00 W. " 31	48	3	3	1909.7	24 15 9	24 14·9	"
70.00 W.— " 31	47	3	3	1909.7	24 16 9	24 12 9	"
15.00 W.— " 32	48	3	3	1909.7	24 37 7	24 47 7	"
66.00 S.— " 29	48	3	3	1909 7	24 38 2	[illegible]	"
43.00 S.— " 19..	48	3	3	1909 7	24 42 1	24 46 1	"
At N.E. cor. sec. 32....	48	3	3	1909 7	24 33 3	[illegible]	"
" " 17..	49	3	3	1909.9	24 34 0	24 34 0	"
20.00 E.—N.E. cor. sec. 8..... ..	49	3	3	1910.6	24 44 1	24 44·7	P. A. Carson.
20.00 E.— " 8	49	3	3	1910.7	24 34 1	24 40·9	"
20.00 E.— " 8	49	3	3	1910.7	24 35 0	24 41.8	"
76.20 E.—N.W. cor. sec. 33	56	3	3	1910.7	23 39 [illegible]	23 40·0	Wm. Christie.
31.50 E.— " 34.....	56	3	3	1909.7	23 32 [illegible]	23 40 9	"
69 19 E.— " 36	56	3	3	1909.7	23 41 3	23 45·3	"
55.00 W.—N.E. cor. sec. 35.....	60	3	3	1909 4	23 59 0	23 58·7	A. Saint Cyr.
55.00 W.— " 35	60	3	3	1909.4	23 34 9	23 43·6	"
75.00 W.— " 35....	64	3	3	1910.7	24 09 5	21 10·3	"
4.00 E. ¼ cor. S.E. by. 1..	39	4	3	1910.7	24 21 8	24 25·8	P. A. Carson.

TABLE No. 1.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′ ″	° ′ ″	
12 60 W.—S.E. cor. sec. 1	39	4	3	1910.7	24 28·5	24 28·5	P. A. Carson.
1 60 S.—N.E. cor. sec. 8	46	4	3	1909.7	23 18·4	23 22·4	A. L. McNaughton
11 60 S.— " " 17	47	4	3	1909.7	24 17·8		"
5 00 S.— " " 9	47	4	3	1909.7	24 19·8	24 08·8	"
11 09 E.— " " 7	47	4	3	1909.7	23 15·8	23 19·8	"
72 00 S.— " " 13	48	4	3	1909.8	24 36·5	24 31·2	W. R. Reilly
38 00 S.— " " 1	48	4	3	1909.8	24 29·0	24 36·7	"
50 00 S.— " " 36	48	4	3	1909.7	24 04·2	24 11·7	"
34 95 E.—N.W. cor. sec. 33	56	4	3	1909.7	22 36·1	22 39·6	Wm. Christie
34.95 E. " " 33	56	4	3	1909.7	22 43·1	22 40·6	"
77.00 E.— " " 34	56	4	3	1909.7	23 00·6	23 09·1	"
70 00 W.—N.E. cor. sec. 34	60	4	3	1904.4	22 03·1	22 08·8	A. Saint Cyr.
75.00 E.—N.E. cor. sec. 31	64	4	3	1910.7	21 04·3	21 04·3	"
50 00 N.— " " 19	7	5	3	1908.6	20 21·7	20 28·9	C. F. Miles.
30 00 N. " " 5	25	5	3	1911.5	24 13·0	24 15·2	G. A. Bennett.
10 00 N.—S.E. cor. sec. 1	39	5	3	1910.6	24 09·9	24 10·0	P. A. Carson.
10 00 N.— " " 1	39	5	3	1910.6	24 19·7	24 17·8	"
12 00 N.—S.E. cor. sec. 1	39	5	3	1910.6	24 13·8	24 11·9	D. E. Chartrand.
1 00 S.—N.E. cor. sec. 9	46	5	3	1911.4	22 52·7		E. W. Hubbell.
11 00 S.— " " 23	46	5	3	1911.4	23 34·1	23 34·5	"
At N.E. cor. sec. 7	49	5	3	1910.7	20 47·2	20 42·0	P. A. Carson.
" "	49	5	3	1910.7	20 44·9	20 40·7	"
15 20 E.—N.W. cor. sec. 35	56	5	3	1909.7	20 39·5	20 43·6	Wm. Christie.
49 03 E. " " 35	56	5	3	1909.7	20 56·0	20 54·0	"
67.00 E.— " " 35	56	5	3	1909.7	20 29·9	20 39·9	"
53 61 E.—N.W. cor. sec. 33	56	5	3	1909.7	21 09·5	21 07·5	"
12 15 E. " " 34	56	5	3	1909.7	20 52·2	21 00·2	"
56 00 W.—N.E. cor. sec. 34	60	5	3	1909.4	22 01·6	22 12·5	A. Saint Cyr.
56.00 W. " " 34	60	5	3	1909.4	22 21·5	22 22·4	"
65 00 E.—N.E. " 32	64	5	3	1910.7	23 26·2	23 29·2	"
At S.E. cor. sec. 5	23	6	3	1911.8	21 04·4	21 00·4	C. Rinfret
15 60 W.—center sec. 24	33	6	3	1910.6	23 04 0	22 57·5	P. A. Carson.
At centre sec. 24	33	6	3	1910.6	22 46·3	22 55·4	"
3.00 N.—N.E. cor. sec. 34	53	6	3	1911.7	21 00·7	20 59·7	E. W. Hubbell.
4.00 N.—S.E. " 5	55	6	3	1911.7	20 52·9	20 48·9	"
1.87 E.—N.W. cor. sec. 31	56	6	3	1909.7	22 38·6	22 37·4	Wm. Christie.
35 20 E. " " 31	56	6	3	1909.7	21 26·0	21 37·8	"
16 17 E.— " " 32	56	6	3	1909.7	20 36·5	20 40·3	"
16.17 E.— " " 32	56	6	3	1909.7	20 39·3	20 41·1	"
39 00 E.— " " 32	56	6	3	1909.7	20 16·2	20 30·0	"
50.00 E.— " " 33	56	6	3	1909.7	21 42·9	21 39·9	"
20 20 E. " " 34	56	6	3	1909.7	22 21·4	22 33·4	"
49 16 E.—N.W. " 34	56	6	3	1909.7	22 43·9	22 36·9	"
8 74 E.— " " 35	56	6	3	1909.7	22 12 6	22 22·6	"
23 00 E.—N.E. cor. sec. 24	64	6	3	1910.7	25 33·1	25 34·1	A. Saint Cyr.
At N.E. cor. sec. 12	1	7	3	1909 8	20 42·1	20 38·8	C. F. Miles.
55.00 E.—N.E. cor. sec 11	50	7	3	1910.8	21 35·5		E. W. Hubbell.
60 60 N. " " 8	52	7	3	1910 8	22 07·3	22 08·4	"
35.00 N.— " " 4	53	7	3	1910 8	23 23·0	23 22 7	"
47 00 E.—S.E. cor. sec. 3	55	7	3	1911.7	23 31·0	23 27·0	"
65.37 E.—N.W. " 32	56	7	3	1909 6	25 33·3	25 35·4	Wm. Christie.
61 91 E. " " 33	56	7	3	1909.7	24 52·4	24 48·2	"
60.00 E.— " " 34	56	7	3	1909.7	21 56·0	22 09 8	"
15.00 W.—N.E. cor. sec. 36	60	7	3	1909 5	23 04·1	23 08 7	A. Saint Cyr.
40 00 W. " " 33	64	7	3	1910.8	25 36 0	25 37·1	"
At N.E. cor. sec. 31	64	7	3	1910.8	25 25·5	25 26·6	"
1 00 N.—N.E. cor. sec. 17	49	8	3	1910.8	22 24 9	22 24·0	E. W. Hubbell.
15.00 N.— " " 3	50	8	3	1910.8	22 58·2	22 58·3	"
15.00 N.— " " 24	51	8	3	1910.8	23 22·0	23 22·1	"
At N.E, cor. sec. 34	51	8	3	1910.8	23 34·2	23 32·9	"
" " 36	51	8	3	1910 8	23 09·9	23 08 6	"
37.86 E.—N.W. cor. sec. 35	56	8	3	1909.6	24 45·4	24 43·5	Wm. Christie.
10 00 E. " " 36	56	8	3	1909.6	25 45·2	25 55·3	"
55 25 E.— " " 33	56	8	3	1909.6	25 49·0	25 55·1	"
18.29 E.— " " 34	56	8	3	1909.6	25 45·3	25 41·4	"
50.29 E.— " " 34	56	8	3	1909.6	24 37 8	24 49·9	"

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
31 00 W.—N.E. cor. sec. 35	60	8	3	1909.5	25 41·4	25 42·6	A. Saint Cyr.
31 00 W.— " " 25	60	8	3	1909.5	25 34·3	25 47·5	"
24 30 W.— " " 23	60	8	3	1909.5	25 25·2	25 18·4	"
25 00 W.— " " 31	64	8	3	1910.8	25 31·8	25 27·9	"
25 00 W.— " " 31	64	8	3	1910.8	24 25·1	24 28·2	"
N. E. cor. sec. 32	50	9	3	1911.9	23 57·6		E. W. Hubbell
0 30 E.—N. E. cor. sec. 21	51	9	3	1911.9	24 29·5	24 26·0	"
4 30 E. " " 23	52	9	3	1911.8	24 30·4	24 26·2	"
5 00 S. " " 26	55	9	3	1911.9	24 25·3	24 20·9	"
72 00 E.—N. W. cor. sec. 32	55	9	3	1909.6	23 17·1	23 22·2	Wm. Christie
75 03 E. " " 34	56	9	3	1909.6	23 21·3	23 27·4	"
15 00 W.—N. E. " 4	50	9	3	1909.5	24 32·5	24 29·4	A. Saint Cyr.
15 00 E.— " " 31	64	9	3	1910.8	24 30·8	24 29·5	"
At N.E. cor. sec. 20	21	10	3	1909.4	21 34.6	21 32.7	C. F. Miles.
At N.W. " " 19	49	10	3	1911.5	24 40.0	24 44.1	E. W. Hubbell.
54 40 W.—N.E. " 23	50	10	3	1911.9	24 23.9	24 18.4	"
30 00 W.—N.E. " 36	51	10	3	1911.9	23 38.9	23 34.4	"
32 55 E.—N.W. " 32	56	10	3	1909.6	24 49.0	24 52.9	Wm. Christie.
7 30 W.—N.E. " 35	60	10	3	1909.6	23 23.9	23 28.0	A. Saint Cyr.
At N.E. " 32	49	11	3	1911.4	24 20.0		E. W. Hubbell.
20 00 S.—N.E. " 33	51	11	3	1911.9	22 17.7	22 13.2	"
At N.E. " 35	51	11	3	1911.7	22 19.3	22 15.3	"
8 55 E.—N.W. " 33	55	11	3	1909.6	25 23.8	25 31.7	Wm. Christie
7.00 W.—N.E. " 32	60	11	3	1909.6	24 42.9	24 42.0	A. Saint Cyr.
40 02 N. " 9	49	12	3	1909.9	24 35.2	24 34.2	W. R. Reilly.
10 00 S. " 5	49	12	3	1909.9	24 24.5	24 31.5	"
40 00 N. " 19	49	12	3	1909.9	24 20.4	24 26.4	"
20 00 N.— " 6	49	12	3	1909.9	24 25.8	24 21.8	"
At N.E. cor. sec. 23	49	12	3	1909.9	24 28.2	24 34.2	"
10 00 S.—N.E. cor. sec. 2	49	12	3	1909.9	24 27.6	24 27.6	"
10 00 N. " 7	49	12	3	1909.9	24 17.1	24 21.1	"
9.00 S.— " 32	50	12	3	1910.9	24 16.7	24 17.1	E. W. Hubbell.
At N.E. cor. sec. 12	52	12	3	1911.7	24 04.1	24 01.9	"
67 00 E.—N.W. cor. sec. 4	56	12	3	1909.6	25 29.4	25 36.3	Wm. Christie.
10 00 W.—N.E. " 1	60	12	3	1909.6	25 24.8	35 26.9	A. Saint Cyr.
30 00 W. " 2	3	13	3	1909.7	20 44.6		C. F. Miles.
At N.E. cor. sec. 19.	50	13	3	1910.9	24 21.5		E. W. Hubbell.
1 00 E. S. "	1	13	3	1910.9	24 24.2	24 23.6	"
17 00 S.—N.E. cor. sec. 13	52	13	3	1911.7	23 20.0	23 16.0	"
18 00 E.—N.W. " 29	56	13	3	1909.5	24 20.4		Wm. Christie.
63 00 W.—N.E. " 31	60	13	3	1909.7	26 10.4	26 13.4	A. Saint Cyr.
At N.E. cor. sec. 33	64	13	3	1911.3	26 46.5		"
" "	64	13	3	1911.3	27 04.6		"
" "	64	13	3	1911.3	27 03.4	27 04.8	"
" "	64	13	3	1911.3	26 57.8	27 00.2	"
At N.E. cor. sec. 31.	52	14	3	1909.9		25 28.9	E. W. Hubbell.
53 55 E.—N.W. cor. sec. 33	56	14	3	1909.5	26 57.3	27 04.5	Wm. Christie.
At N.E. cor. sec. 31	64	14	3	1911.3		25 29.9	A. Saint Cyr.
At P.C. 1 in L. 7	41	15	3	1910.7	24 27.7	24 26.7	P. A. Carson.
10 00 W. P.C. No. 1 in L. 27	41	15	3	1910.7	24 24.9	24 30.5	"
17.32 E.—N.W. " 6	55	15	3	1909.5			Wm. Christie.
70 00 E. "	56	15	3	1909.5	27 06.6	27 16.2	"
18 00 E. "	56	15	3	1909.5	27 04.0	27 10.6	"
57 00 E. " 3	56	15	3	1909.5	27 16.6	27 17.7	"
9.00 W.—N.E. cor. sec. 33.	64	15	3	1909.5	27 13.4	27 26.0	"
6.00 N.—9.00 W. ¼ cor. N. By. 6.	47	15	3	1911.3	26 29.4	26 30.8	A. Saint Cyr.
At S.W. cor. sec. 6.	52	16	3	1910.7	24 17.7	24 23.7	P. A. Carson.
60.63 S.—N.E. cor. sec. 24.	53	16	3	1911.6	25 56.3	26 00.8	E. W. Hubbell.
45.00 E.—N.W. " 32	56	16	3	1910.9	26 31.8	26 28.2	"
42.79 E.— " " 33.	56	16	3	1909.5	26 51.6	26 56.2	Wm. Christie
20.00 W.—N.E. cor. sec. 34.	60	16	3	1909.5	26 46.8	26 57.4	"
56 00 W. " 4	64	16	3	1909.8	25 01.1	25 03.8	A. Saint Cyr.
At ¼ cor. E. B. sec. 12	47	17	3	1911.3	25 37.0		"
At N.E. cor. sec. 31.	53	17	3	1910.7	24 22.4	24 22.4	P. A. Carson.
17.00 N.—S.E. cor. sec. 4.	56	17	3	1910.8	26 17.3	26 23.4	C. F. Miles.
				1911.7	26 01.0	25 58.2	E. W. Hubbell.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Orig'l.	Declination. Reduced to 1912 0.	Observer.
50.00 E.—N.W. cor. sec. 31	56	17	3	1909.4	26 23.5	26 22.4	Wm. Christie.
52.00 E.— " 32	56	17	3	1909.4	25 56.6		"
At N.E., cor. sec. 35	57	17	3	1911.7	26 35.1	26 31.3	E. W. Hubbell.
" " 21	59	17	3	1911.6	26 03.5	26 01.0	"
22.00 W.—N.E., cor. sec. 34	60	17	3	1909.8	25 14.0		A. Saint Cyr.
7.00 W.— " 36	64	17	3	1911.4	25 34.7	25 29.7	"
45.00 S.— " 36	1	18	3	1909.7	20 01.9	20 00.9	C. F. Miles.
39.00 N.— " 11	25	18	3	1909.5	22 01.2	22 03.6	"
At N.E. cor. sec. 8	53	18	3	1910.8	26 40.3	26 45.6	"
" 34	53	18	3	1910.8	26 04.5	26 07.6	"
" 31	56	18	3	1909.4	25 57.1	25 60.0	Wm. Christie.
65.55 E.—N.W. cor. sec. 32	56	18	3	1909.4	25 57.4	25 48.3	"
At N.E. cor. sec. 34	58	18	3	1911.6	26 16.5	26 16.0	E. W. Hubbell.
" 10	59	18	3	1911.6	26 22.0	26 19.5	"
25.00 W.—N.E. cor. sec. 33	60	18	3	1909.8	25 45.9		A. Saint Cyr.
At N.E. cor. sec. 32	60	18	3	1911.6	25 47.2	25 46.7	E. W. Hubbell.
78.00 W.—N.E. cor. sec. 33	64	18	3	1911.4	26 50.9	26 49.7	A. Saint Cyr.
10.00 W.—S.E. cor. sec. 3	55	19	3	1910.7	26 11.2	26 10.7	C. F. Miles.
67.00 E.—N.W. cor. sec. 32	56	19	3	1909.4	26 11.7	26 17.4	Wm. Christie.
26.65 S.—N.E. cor. sec. 20	58	19	3	1911.6	25 31.9	25 29.4	E. W. Hubbell.
At N.E. cor. sec. 36	60	19	3	1911.6	25 30.3	25 28.8	"
" 34	60	19	3	1911.6	25 17.9	25 18.4	"
25.00 W.—N.E. cor. sec. 33	60	19	3	1909.9	25 35.4	25 38.4	A. Saint Cyr.
64.00 W.— " 34	64	19	3	1911.4	26 51.0	26 53.8	"
30.00 N.— " 29	54	20	3	1910.7	25 60.2	25 00.2	C. F. Miles.
At N.E. cor. sec. 10	54	20	3	1910.8	25 04.1	25 09.2	"
At N.E. cor. sec. 19	56	20	3	1910.7	26 10.7		C.F. Miles
36.22 E.—N.W. cor. sec. 32	56	20	3	1909.4	26 42.8	26 38.5	Wm. Christie.
2.00 E.— " 33	56	20	3	1909.4	26 23.3	26 29.0	
75.00 W.—N.E. cor. sec. 34	60	20	3	1909.9	25 15.2		A. Saint Cyr.
27.00 W.— " 34	64	20	3	1911.4	26 00.1	26 02.5	"
At N.E. cor. sec. 36	56	21	3	1910.7	33 13.5	33 09.9	C.F. Miles.
1.00 E.—N.W. cor. sec. 34	56	21	3	1909.4	26 09.6	26 13.3	Wm. Christie.
At N.E. cor. sec. 19	57	21	3	1910.7	25 25.9		C F. Miles.
22.00 W.—N.E. cor. sec. 36	64	21	3	1911.5	26 35.9	26 30.5	A. Saint Cyr
22.00 W.— " 36	64	21	3	1911.5	26 16.9	26 21.0	"
66.00 W.— " 34	64	21	3	1911.5	26 21.2	26 19.8	"
At N.E. cor. sec. 35	53	22	3	1910.8	24 35.5		C. F. Miles.
27.00 E.—N.W. cor. sec. 33	56	22	3	1909.4	26 15.7	26 17.9	Wm. Christie
12.00 W.—N.E. " 32	64	22	3	1911.5	26 07.5	26 06.6	A. Saint Cyr.
At N.E. cor. sec. 14	3	23	3	1909.7	21 32.7	21 31.7	C.F. Miles.
10.00 N.—N.E. cor. sec. 15	7	23	3	1911.4	21 35.9		A.L. Cumming
20.00 N.— " 26	7	23	3	1911.5	21 37.2	21 34.3	"
5.00 N.— " 7	7	23	3	1911.5	21 26.4	21 28.5	"
20.00 S.— " 25	7	23	3	1911.5	21 40.9	21 40.0	"
40.00 S.— " 18	37	23	3	1910.8	24 13.7	24 13.8	P.A.Carson.
10.00 N.—S.E. cor. sec. 6	54	23	3	1909.9	24 25.3	24 27.3	G. J. Lonergan.
20.00 N.—N.E. cor. sec. 28	55	23	3	1910.8	26 10.7		C.F. Miles.
50.00 S.— " 4	56	23	3	1910.8	26 32.6		"
62.00 E.—N.W. " 32	56	23	3	1909.3	26 12.4	26 15.4	Wm. Christie.
At N.E. cor. sec. 33	57	23	3	1910.8	26 08.5	26 09.6	C.F. Miles.
69.00 W.—N.E. cor. sec. 33	64	23	3	1911.5	25 33.8	25 38.9	A. Saint Cyr.
15.00 N.— " 14	7	24	3	1911.5	21 37.4	21 37.5	G.L. Cumming.
30.00 S.— " 16	7	24	3	1911.5	21 41.4	21 35.5	"
10.00 N.—S.E. " 4	7	24	3	1911.5	21 25.9	21 33.0	"
8.00 N.—N.E. " 20	7	24	3	1911.5	21 30.3	21 30.5	"
10.00 N.—S.E. " 2	54	24	3	1909.9	24 26.5	24 32.5	A. J. Lonergan.
63.00 E.—N.W. " 35	56	24	3	1909.3	26 14.8	26 18.0	Wm. Christie.
10.00 S.—N.E. " 29	57	24	3	1910.5	25 49.6	25 54.4	H.S. Holcroft.
30.00 S.— " 21	58	24	3	1910.8	25 43.7	25 43.8	C.F. Miles.
30.00 W.— " 33	64	24	3	1911.5	26 29.4	26 24.6	A. Saint Cyr.
30.00 W.— " 33	64	24	3	1911.5	26 17.0	26 22.2	"
30.00 W.— " 33	64	24	3	1911.5	26 20.9	26 19.1	"
At N.E. cor. sec. 32	14	25	3	1910.5	22 29.9	22 34.7	C.F. Miles.
" " 21	15	25	3	1910.5	23 53.6	23 54.0	"
" " 25	37	25	3	1910.8	24 07.9		P.A.Carson.

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
At N.E. cor. sec. 25	37	25	3	1910.8	24 11.2	24 10.3	P. A. Carson.
35.00 N.—N.E. cor. sec. 26	37	25	3	1910.8	23 47.7	23 53.8	"
At N.E. cor. sec. 5	47	25	3	1910.7	24 17.2	24 19.2	"
15.00 W.—N.E. cor. sec. 18	48	25	3	1910.7	24 47.1	24 50.6	"
15.00 W.— " 18	48	25	3	1910.7	24 49.2	24 51.2	"
15.00 W.— " 18	48	25	3	1910.7	24 47.6	24 45.6	"
15.00 W.— " 18	48	25	3	1910.7	24 46.7	24 45.5	D. E. Chartrand.
15.00 W.— " 18	48	25	3	1910.7	24 43.5	24 43.5	"
15.00 W.— " 18	48	25	3	1910.7	24 36.4	24 36.4	P. A. Carson.
15.00 W.— " 18	48	25	3	1910.7	24 34.5	24 35.5	"
15.00 W.— " 18	48	25	3	1910.7	24 30.7	24 34.7	"
15.00 W.— " 18	48	25	3	1910.7	24 33.9	24 40.9	"
15.00 W.— " 18	48	25	3	1910.7	24 26.6	24 34.6	"
15.00 W.— " 18	48	25	3	1910.7	24 37.7	24 43.7	D. E. Chartrand.
15.00 W.— " 18	48	25	3	1910.7	24 37.3	24 43.3	"
15.00 W.— " 18	48	25	3	1910.7	24 37.1	24 44.1	"
15.00 W.— " 18	48	25	3	1910.7	24 40.8	24 46.3	"
15.00 W.— " 18	48	25	3	1910.7	24 38.9	24 40.9	"
15.00 W.— " 18	48	25	3	1910.7	24 41.6	24 42.1	"
15.00 W.— " 18	48	25	3	1910.7	24 39.0	24 39.5	"
15.00 W.— " 18	48	25	3	1910.7	24 38.8	24 38.8	"
15.00 W.— " 18	48	25	3	1910.7	24 39.4	24 39.4	"
15.00 W.— " 18	48	25	3	1910.7	24 41.0	24 41.0	"
62.00 E.—N.W. cor. sec. 32	56	25	3	1909.3	26 25.5	26 20.7	Wm. Christie.
33.00 E.—N.W. cor. sec. 33	56	25	3	1909.3	25 45.9	25 55.1	"
60.00 N.—N.E. " 23	57	25	3	1910.5	26 01.5	25 57.9	H. S. Holeroft.
At N.E. cor. sec. 27	57	25	3	1910.5	25 43.9	25 44.3	"
Near S.E. cor. sec. 31	63	25	3	1911.6	26 21.4	26 17.9	A. Saint Cyr
64.00 W.—N.E. cor. sec. 36	64	25	3	1911.5	25 49.6	25 50.8	"
43.00 W.— " 33	64	25	3	1911.5	25 52.4	25 49.6	"
10.00 S. 30.00 W.—N.E. cor. sec. 19	40	26	3	1910.8	23 40.8	23 36.9	D.E.Chartrand.
"	40	26	3	1910.8	23 43.6	23 40.7	P. A. Carson.
"	40	26	3	1910.8	23 44.2	23 39.3	"
30.00 N.—S.E. cor. sec. 11	54	26	3	1909.8	24 42.1	.....	G. J. Lonergan
10.00 S.—N.E. " 31	55	26	3	1909.8	26 37.9	26 33.2	"
5.00 S.— " " 32	55	26	3	1909.8	26 27.6	26 29.9	"
At N.E. cor. sec. 35	56	26	3	1909.3	25 53.0	25 57.2	Wm. Christie.
5.00 N.—N.E. cor. sec. 7	57	26	3	1910.8	25 21.1	25 19.8	C.F. Miles.
At N.E. cor. sec. 35	59	26	3	1910.8	26 00.7	26 00·4	C. F. Miles
48.00 W.—N.E. cor. sec. 31	60	26	3	1910.2	25 23.4	25 30.6	A. Saint Cyr.
15.00 W.— " 35	60	26	3	1910.1	25 02.9	25 08.9	"
13.00 W.— " 34	61	26	3	1911.6	24 40.8	24 39·7	"
13.00 W.— " 34	64	26	3	1911.6	24 48·6	24 44·5	"
13.00 W.— " 34	64	26	3	1911.6	24 37·8	24 41·2	"
8.00 N.— " 7	65	26	3	1911.6	25 52·9	25 50·8	"
At ¼ cor. N. by sec. 7	48	27	3	1910.7	25 26·6	25 29·6	P. A. Carson.
10.00 S.—N.E. cor. sec. 11	53	27	3	1909.9	25 40.4	25 39·4	G. J. Lonergan.
10.00 E.— " " 35	55	27	3	1909.8	27 14·4	27 11·7	"
15.00 N.—S.E. " 1	56	27	3	1909.8	27 13·5	27 09·8	"
72·50 E.—N.W. " 36	56	27	3	1909.3	25 54·0	25 57·2	Wm. Christie.
30.25 W.—N.E. " 35	60	27	3	1910.2	25 15·4	25 20·1	A. Saint Cyr.
40.00 S.— " " 24	14	28	3	1911.6	21 40.9	21 39·4	C. Rinfret.
3.00 N.— " " 21	15	28	3	1911.7	22 40·9	22 38·1	"
20.00 N.— " " 1	1	29	3	1909.6	21 40·9	21 42·0	C. F. Miles.
40.00 N.— " " 9	14	1	4	1910.9	22 13·5	22 12·2	"
13.80 E.— " " 8	43	1	4	1911.7	25 03.2	24 59·2	R. C. Purser.
20.00 S.— " " 34	57	1	4	1909.8	25 21.2	.....	G. J. Lonergan.
5.00 N.—S.E. " 3	58	1	4	1909.8	25 14.3	25 13.0	"
20.00 S.—N.E. " 31	62	1	4	1909.8	25 18.4	25 21·1	"
12.00 S. " " 25	62	1	4	1911.6	26 05.0	26 01.5	A. Saint Cyr.
12.00 S.— " " 25	62	1	4	1911.6	26 18.6	26 12·1	"
12.00 S.— " " 25	62	1	4	1911.6	26 18.5	26 13.0	"
12.00 S.— " " 25	62	1	4	1911.6	26 00.2	26 03·7	"
5.00 N.—S.E. " 5	63	1	4	1909.8	25 29.0	25 31·7	G. J. Lonergan.
7.00 N.—N.E. " 25	63	1	4	1909.2	25 15.2	25 11·3	J. N. Wallace.
40.00 N.— " " 12	63	1	4	1911.6	25 58.3	25 50.8	A. Saint Cyr.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
40.00 N.—N.E. cor. sec. 12	63	1	4	1911.6	25 46·2	25 46·7	A. Saint Cyr.
40.00 N.— " " 12	63	1	4	1911.6	25 51·1	25 48·6	"
2.30 S.— " " 24	65	1	4	1911.6	26 15·8	26 13·3	"
2.00 N.— " " 13	65	1	4	1911.6	26 04·2	26 01·7	"
2.00 N.— " " 13	65	1	4	1911.6	26 19·1	26 08·6	"
2.00 N.— " " 13	65	1	4	1911.6	26 01·1	26 06·6	"
2.00 N.— " " 13	65	1	4	1911.6	26 03·2	26 05·7	"
2.00 N.— " " 13	65	1	4	1911.6	26 09·9	26 06·4	"
39.00 N.—S.E. " 13	65	1	4	1909.3	25 48·6	25 51·8	J. N. Wallace.
5.00 N.—N.E. " 25	67	1	4	1909.3	26 31·0	26 25·2	"
61.21 W.— " " 35	68	1	4	1910.4	26 44·0	26 49·1	Wm. Christie.
19.00 W.— " " 32	68	1	4	1910.4	26 37·5	26 39·6	"
9.00 N.—S.E. " 25	69	1	4	1909.4	26 18·1	26 13·0	J. N. Wallace.
75.00 S.—N.E. " 1	69	1	4	1909.4	27 22·6	27 16·3	"
64.00 N.—S.E. " 1	71	1	4	1909.5	26 53·1	26 49·5	"
16.05 W.—N.E. " 36	72	1	4	1910.6	26 24·4	26 24·2	E. J. Saunders.
59.41 W.— " " 34	76	1	4	1910.7	27 44·9	27 46·9	Wm. Christie.
68.27 W.— " " 31	76	1	4	1910.7	27 11·5	27 11·5	"
80.70 S.— " " 1	77	1	4	1909.8	28 08·2	28 11·9	J. N. Wallace.
3.00 N.— " " 13	78	1	4	1909.8	27 10·4	27 10·1	"
7.00 N.— " " 25	78	1	4	1909.8	27 07·1	26 57·8	"
14.00 N.— " " 13	79	1	4	1909.8	26 54·3	26 49·0	"
5.00 N.— " " 1	80	1	4	1909.9	26 14·7	26 08·9	"
40.00 N.—N.E. " 24	80	1	4	1909.9	27 06·8	27 02·2	J. N. Wallace.
65.00 N.— " " 1	82	1	4	1910.5	28 04·5	28 08·3	"
47.00 N.— " " 12	83	1	4	1910.5	28 33·0	28 38·8	"
75.65 N.—S.E. " 25	83	1	4	1910.5	28 59·5	29 04·3	"
53.00 N.— " " 1	86	1	4	1910.6	27 34·0	27 39·1	"
64.00 N.—N.E. " 25	86	1	4	1910.6	27 41·8	27 46·9	"
33.84 N.— " " 13	87	1	4	1910.6	25 42·5	25 45·6	"
1.64 N.— " " 25	87	1	4	1910.6	27 24·1	27 29·2	"
5.00 W.— " " 35	88	1	4	1911.5	31 09·9	31 07·0	G. H. Blanchet.
72.31 N.—S.E. " 1	88	1	4	1910.6	28 10·4	28 14·5	J. N. Wallace.
77.24 N.—N.E. " 12	88	1	4	1910.6	28 29·3	28 35·4	"
26.00 N.— " " 12	89	1	4	1910.7	30 32·2	30 36·7	"
21.61 N.— " " 36	89	1	4	1910.7	29 48·2	29 49·7	"
53.00 N.— " " 24	90	1	4	1910.7	26 05·5	.. ....	"
10.00 N.— " " 1	91	1	4	1910.8	26 22·2	... ...	"
45.00 N.— " " 24	91	1	4	1910.8	26 19·3	26 23·4	"
5.00 S.— " " 36	91	1	4	1910.8	25 49·3	25 48·4	"
70.00 N.— " " 12	92	1	4	1910.8	27 29·1	27 25·2	"
70.00 N.— " " 12	92	1	4	1910.8	27 19·7	27 23·8	"
70.00 N.— " " 12	92	1	4	1910.8	27 23·7	....	"
24.23 W.—N.E. " 36	92	1	4	1911.8	28 16·7	28 10·7	J. B. McFarlane.
59.00 N.— " " 24	93	1	4	1910.8	30 18·5	30 14·2	J. N. Wallace.
59.00 N.— " " 24	93	1	4	1910.8	30 19·7	30 18·4	"
59.00 N.— " " 24	93	1	4	1910.8	30 31·3	30 30·0	"
32.00 N.— " " 24	94	1	4	1910.9	30 57·1	30 52·5	"
32.00 N.— " " 36	94	1	4	1910.9	30 49·1	30 47·0	"
32.00 N.— " " 36	94	1	4	1910.9	30 48·3	30 49·7	"
3.00 N.— N.E. cor. sec 1	95	1	4	1910.9	31 08·8	... .	J. N. Wallace.
24.93 N.— " 24	96	1	4	1911.5	31 13·3	31 15·4	J. B. McFarlane.
1.27 N.— " 1	97	1	4	1911.5	31 20·8	31 22·9	"
68.67 N.— " 1	97	1	4	1911.5	31 05·1	31 07·2	"
53.44 N.— " 12	97	1	4	1911.5	31 14·8	31 18·0	"
51.07 N.— " 13	97	1	4	1911.5	31 13·3	31 13·5	"
2.20 N.— " 24	97	1	4	1911.5	31 15·0	31 16·2	"
77.73 N.— " 24	97	1	4	1911.5	31 31·3	31 32·5	"
10.33 N.— " 12	98	1	4	1911.5	31 21·6	.....	"
76.46 N.— " 24	98	1	4	1911.5	30 58·0	30 57·2	"
31.96 N.— " 1	99	1	4	1911.5	31 16·7	31 18·9	"
9.73 N.— " 13	99	1	4	1911.5	30 22·3	30 22·5	"
29.77 N.— " 1	100	1	4	1911.6	30 01·8	30 01·7	"
29.77 N.— " 1	100	1	4	1911.6	29 58·5	29 58·4	"
13.75 N.— " 12	100	1	4	1911.6	30 09·9	30 09·8	"
45.20 N.— " 24	100	1	4	1911.6	32 11·3	32 10·2	"

TABLE No. 4—*Continued.*

Place.	Tp	Rge.	Mer	Date.	Declination.		Observer.
					Obsd.	Reduced to 1912.0	
					° ′	° ′	
37.26 N.—N.E. cor. sec. 36	109	1	4	1911 6	32 15 2	32 16·7	J. B. McFarlane.
23 65 N " 12	101	1	4	1911.6	32 03 7	32 02·2	"
27 67 N " 36	101	1	4	1911.6	33 08 7	33 07·2	"
51 72 N " 25	101	1	4	1911 6	33 27·4	33 25·9	"
7.67 N " 1	102	1	4	1911 6	33 44·4	33 40·9	"
69.72 N " 1	102	1	4	1911 7	33 33 6	33 31·8	"
2.31 N " 25	102	1	4	1911 7	31 41 9	31 39·1	"
69 72 N " 1	102	1	4	1911.7	33 33 3	33 30·5	"
23 85 N " 25	102	1	4	1911 7	31 40·0	31 38 2	"
57.38 N " 13	103	1	4	1911 7	31 48 3	31 44 5	"
74 64 N " 1	103	1	4	1911 7	31 26 3	31 22·3	"
71 60 N " 13	103	1	4	1911 7	31 19 8	31 15·8	"
30 58 N " 24	103	1	4	1911.7	31 17·2	31 14·2	"
78.70 N " 36	104	1	4	1911 7	30 14 2	30 39 2	"
13.12 N " 1	104	1	4	1911 7	31 19 0	31 14.0	"
16.84 N " 12	104	1	4	1911 7	31 07 8	31 02·8	"
55.33 N " 13	104	1	4	1911 7	31 08 3	31 04·3	"
15.64 N " 13	104	1	4	1911.7	31 11 1	31 07·1	"
75.64 N " 24	105	1	4	1911 7	30 45 1	30 41·1	"
47.11 N " 1	105	1	4	1911 7	30 44·0	30 42·0	"
7.00 S " 2	62	2	4	1909 8	24 59·2	25 00 9	G. J. Lonergan
50.00 N " 23	62	2	4	1909 8	24 56 1	24 57·8	"
27 00 W " 35	68	2	4	1910 4	26 52·4	26 58 5	Wm. Christie.
26 36 W " 33	68	2	4	1910.4	27 15·5	27 21 6	"
13.06 W " 31	68	2	4	1910.4	27 09 0	27 13·1	"
0.04 W " 35	72	2	4	1910.7	27 40·7	27 44·7	B. J. Saunders.
68 01 W " 36	76	2	4	1910 7	26 52 6	26 56·1	Wm. Christie.
68 27 W " 32	76	2	4	1910 7	26 47·4	26 45·9	"
36 69 W " 35	92	2	4	1911 8	29 19·6	29 15 6	J. B. McFarlane.
66 17 W " 35	92	2	4	1911 8	29 02·0	29 00·0	"
60.59 W " 34	92	2	4	1911 8	28 15 3	28 11·3	"
42 09 W " 33	92	2	4	1911 8	28 05·2	28 03·2	"
At N.E cor. sec. 7	3	3	4	1910.4	21 59·3	22 05·4	C. F. Miles
60 00 N —N.E cor. sec. 7	3	3	4	1909 6	23 08·2		"
On trial line 50.00 N —S.E cor. 3	7	3	4	1911 4	21 52 5	21 57 9	E. S. Martindale.
20 00 N N.E cor. sec. 8	53	3	4	1910 5	26 18 3	26 22·1	G. J. Lonergan.
10 00 N " 31	61	3	4	1911.7	25 36 0	25 33·0	C. F. Mils.
35 00 N " 17	61	3	4	1911 8	26 22·9	26 18 9	"
10.00 S " 34	63	3	4	1910.6	25 46 0	25 48 1	G. J. Lonergan.
20.00 S " 4	64	3	4	1910 6	25 46·1	25 48·2	"
11 91 W " 35	68	3	4	1910 5	26 55·9	26 59 7	Wm. Christie.
61 97 W " 31	68	3	4	1910 5	26 12·6	26 17 4	"
3 58 W " 35	72	3	1	1909 8	28 26 0		B. J. Saunders.
36 95 W " 35	76	3	4	1910.7	26 50 6	26 52·6	Wm. Christie.
36 21 W " 34	76	3	4	1910 7	26 53 8	26 52·8	"
67 23 W " 36	76	3	4	1910 7	27 32·2	27 33·7	"
33 30 W " 35	88	3	4	1911 5	29 16·4	29 16 6	G. H. Blanchet.
64 17 W " 35	92	3	4	1911 8	31 21·3	31 15 1	J. B. McFarlane.
62 00 W " 34	92	3	4	1911 8	31 24·1	31 18·9	"
6.14 W " 33	92	3	4	1911 8	31 24·0	31 27·8	"
43.70 W " 33	92	3	4	1911 8	30 48 3	30 43·1	"
13 70 W " 33	92	3	4	1911 8	30 40·0	30 35·8	"
On trial line 5.00 N N.E cor. 8	7	4	4	1911 1	22 11·1	22 14 5	E. S. Martindale.
At N.E cor. sec. 4	11	4	4	1911 8	21 55 8	21 50 8	G. A. Bennett.
At " 1	16	4	1	1911 8	22 39·6	22 34 6	"
15.00 S N.E. cor. sec. 29	61	4	1	1909 7	26 53·1	26 57 1	G. J. Lonergan.
30.00 E — " 33	62	4	4	1909 7	26 54 8	26 51·8	"
20.00 S — " 35	63	4	1	1910 6	27 1 2		"
58 72 W " 34	63	4	4	1910 5	26 58 3	27 03·1	Wm. Christie.
75 00 W " 32	63	4	4	1910 7	26 19·1	26 23 9	"
73 43 W " 35	72	4	4	1910 8	27 55·5	27 55·1	B. J. Saunders.
12 51 W.—N.E. cor. sec. 35	76	4	4	1910 7	27 27·7	27 27·7	Wm. Christie.
62 56 W " 32	76	4	4	1910 7	27 24 9		"
41 11 W " 36	92	4	4	1911 9	31 29 7	31 33 2	J. B. McFarlane.
13.03 W " 34	92	4	4	1911 9	31 42·9	31 38·4	"
On trial line at N.E cor. sec. 9	7	5	4	1911.5	22 50 5	22 51·4	E. S. Martindale.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
63.87 E.—N.E. cor. sec. 12	44	5	4	1911.7	25 34·9	25 31·9	R. C. Purser.
13.75 W.— " 35	68	5	4	1910.5	26 13·3	26 21·1	Wm. Christie.
32.56 W.— " 32	68	5	4	1910.5	26 23·6	26 28·0	"
42.56 W.— " 34	72	5	4	1910.9	26 59·7	26 59·6	E. J. Saunders.
27.88 W.— " 33	76	5	4	1910·8	27 08·9	27 10·0	Wm. Christie.
72.82 W.— " 31	76	5	4	1910.8	26 46·3	26 50·4	"
12.88 W.— " 35	88	5	4	1911.5	29 10·7	29 12·9	G. H. Blanchet.
15.00 W.— " 34	4	6	4	1910.4	22 42·8	22 46·9	C. F. Miles.
15.60 S.— " 29	63	6	4	1910.6	26 16·2	26 15·3	G. J. Lonergan.
60.40 W.— " 36	68	6	4	1910·5	27 12·9	27 17·3	Wm. Christie.
58.03 W.— " 32	68	6	4	1910.5	27 02·0	27 05·4	"
60.56 W.— " 35	76	6	4	1910·8	26 04·6	26 08·2	"
13.32 W.— " 36	88	6	4	1911.6	29 47·9	29 44·8	G. H. Blanchet.
14.00 W.— " 31	88	6	4	1911·6	32 09·6	32 07·1	"
15.00 N.—S.E. cor. sec. 33	63	7	4	1910·6	26 34·8	26 36·4	G. J. Lonergan.
10.00 N.— " 3	64	7	4	1910·6	26 27·7	26 29·8	"
10.00 N.— " 3	64	7	4	1910.6	26 16·8	26 17·9	"
52.83 W.—N.E. cor. sec. 36	68	7	4	1910.5	26 33·6	26 37·0	Wm. Christie.
65.97 W.— " 33	68	7	4	1910.5	26 37·2	26 42·6	"
77.39 W.— " 35	76	7	4	1910.8	23 19·8	23 20·9	"
75.05 W.— " 32	76	7	4	1910.8	25 57·0	25 56·1	"
7.28 W.—N.E. cor. sec. 34	68	8	4	1910.5	27 15·2	27 21·6	"
77.00 W.— " 33	68	8	4	1910.5	26 55·1	26 59·5	"
5.37 W.— " 36	76	8	4	1910.8	26 46·2	26 47·3	"
20.71 W.— " 33	76	8	4	1910.8	28 03·5	28 04·6	"
16.00 W.— " 36	88	8	4	1911.6	29 08·5	29 06·0	G. H. Blanchet.
76.39 W.— " 32	88	8	4	1911.7	29 55·2	29 55·4	"
Fort Chipewyan	112	8	4	1910.6	28 35·0	28 28·1	C. Engler.
15.00 E.—N.E. cor. sec. 24	7	9	4	1910.4	22 41·5	22 46·6	C. F. Miles.
40.00 S.— " 16	58	9	4	1909.8	26 21·9	26 21·6	H. S. Holcroft.
40.00 " 16	58	9	4	1909.8	26 22·1	26 24·8	"
30.00 N.—N.E. cor. sec. 22	61	9	4	1909.7	26 57·1	.....	G. J. Lonergan.
30.00 S.— " 20	63	9	4	1910.6	27 29·3	.....	"
7.10 W.— " 36	68	9	4	1910.5	26 58·6	27 04·0	Wm. Christie.
72.25 W.— " 35	68	9	4	1910.6	26 44·8	26 49·9	"
45.50 W.— " 33	76	9	4	1910.8	28 24·8	28 23·9	"
9.21 W.— " 31	76	9	4	1910.8	30 11·6	30 11·2	"
38.13 W.— " 33	88	9	4	1911.7	29 19·5	29 13·5	G. H. Blanchet.
6.00 N.— " 6	15	10	4	1911.8	23 48·4	23 44·4	G. A. Bennett.
At S.E. cor. sec. 6	15	10	4	1911.8	23 42·1	23 40·1	"
At N.E. " 8	15	10	4	1911.8	23 55·7	23 53·7	"
40.00 S.—N.E. cor. sec. 2	58	10	4	1909.7	26 24·7	26 28·7	H. S. Holcroft.
40.00 S.— " 2	58	10	4	1909.7	26 18·1	26 23·1	"
15.00 N.—S.E. " 3	61	10	4	1909.7	26 47·0	26 46·0	G. J. Lonergan.
15.00 N.—N.E. " 21	62	10	4	1909.7	27 16·1	27 16·1	"
45.00 S.— " 32	63	10	4	1911.7	27 14·5	27 11·7	C. F. Miles.
2.05 W.— " 35	68	10	4	1910·6	25 53·0	25 58·1	Wm. Christie.
48.84 W.— " 34	68	10	4	1910.6	27 00·0	27 05·1	"
50.77 W.— " 32	68	10	4	1910.6	27 23·9	27 26·0	"
7.80 W.— " 33	88	10	4	1911.7	29 03·4	28 54·4	G. H. Blanchet.
Fort McMurray, S. shore Athabaska R. op. Is	88	10	4	1910.4	29 50·0	29 54·1	C. Engler.
" "	88	10	4	1910.4	29 53·0	29 59·1	"
" "	88	10	4	1910.6	29 48·0	29 50·1	"
" "	88	10	4	1910.6	30 15·2	.....	"
73.47 W.—N.E. cor. sec. 35	68	11	4	1910.6	27 37·0	27 41·1	Wm. Christie.
36.58 W.— " 32	68	11	4	1910.6	27 34·5	27 36·6	"
45.00 W.— " 33	88	11	4	1911.7	29 54·4	29 54·4	G. H. Blanchet.
Athabaska River, at Powder Shack	96	11	4	1910.5	26 01·7	26 05·5	C. Engler.
At S.W. cor. H.B. Co. residence	125	11	4	1910.5	28 04·1	28 07·5	J. A. Coté.
"	125	11	4	1910.5	28 10·9	28 12·3	C. Engler.
18.00 N.—N.E. cor. sec. 33	1	12	4	1911.4	22 52·4	22 49·8	P. B. Street.
At N. E. cor. sec. 10	2	12	4	1911.4	23 08·6	.....	"
5.00 S.—N. E. cor. sec. 8	12	12	4	1910.8	23 49·2	23 50·3	W. A. Scott.
20.00 N.— " 6	57	12	4	1909.7	26 16·1	26 16·1	H. S. Holcroft.
20.00 N.— " 6	57	12	4	1909.7	26 09·2	26 15·2	"

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination		Observer.
					Obs'd.	Reduced to 1910.0	
					° ′	° ′	
20.00 W.— N.E. cor. sec. 35	65	12	4	1910.6	27 11.7	27 11·8	G. J. Lonergan.
2.00 N.— S.E. cor. sec. 2	66	12	4	1910.6	27 14 3	27 13·9	"
60.25 W.— N.E. " 35	68	12	4	1910 6	28 00 6	28 03·7	Wm. Christie.
13 21 W.— " 32	68	12	4	1910.6	28 07.4	28 09 0	"
Athabaska River, Big Cascades E. side of river	87	12	4	1910.4	30 55.0	30 56·1	J. A. Coté.
" "	87	12	4	1910 4	30 46.5	30 48 6	C. Engler.
" "	87	12	4	1910.4	29 59 2	30 03 3	
Fort Smith	127	12	4	1910.6	32 55 1	32 56 2	J. A. Coté.
"	127	12	4	1910.6	32 46.9	32 57·5	"
"	127	12	4	1910 6	32 47.1	32 48.7	"
"	127	12	4	1910.6	33 08 1	33 07 2	"
"	127	12	4	1910.6	32 53.7	32 55.8	"
"	127	12	4	1910.6	32 55.2	33 01.3	"
"	127	12	4	1910 6	32 51.4	32 52.5	"
"	127	12	4	1910 5	33 04.6	33 08.0	"
"	127	12	4	1910.5	32 58.7	33 07.1	"
"	127	12	4	1910 5	32 59.2	33 04.6	"
"	127	12	4	1910 6	33 07 7	33 06.8	"
"	127	12	4	1910.6	32 55 9	32 58.0	"
"	127	12	4	1910 6	32 57.1	33 02.2	"
"	127	12	4	1910.6	32 58.0	32 57.6	"
"	127	12	4	1910.6	33 08.7	33 05.8	"
"	127	12	4	1910.5	33 07.9	33 11.3	"
"	127	12	4	1910.5	33 13.8	33 14.2	"
"	127	12	4	1910.5	33 10.6	33 19 0	"
"	127	12	4	1910.5	32 52.1	33 01.5	"
"	127	12	4	1910 5	32 48.3	32 51.7	"
"	127	12	4	1910.5	33 10.1	33 05 5	"
"	127	12	4	1910 5	33 08 1	33 17.5	"
"	127	12	4	1910.5	32 49 9	32 55.8	"
"	127	12	4	1910 5	32 55.5	32 57 9	"
"	127	12	4	1910.5	33 01.0	33 02.4	"
"	127	12	4	1910.5	32 54.0	33 03 9	"
"	127	12	4	1910.5	32 53.1	32 59.5	"
"	127	12	4	1910 5	32 53.4	32 55.3	"
"	127	12	4	1910.5	33 11.4	33 09.8	"
"	127	12	4	1910 5	32 55.4	33 05.8	"
"	127	12	4	1910.6	32 52.4	32 59.5	"
"	127	12	4	1910.6	32 51.2	32 54.8	"
"	127	12	4	1910.6	33 12.2	33 08.3	"
"	127	12	4	1910 6	32 54.4	33 01 5	"
Centre L.S. 7, sec. 4	2	13	4	1911.4	22 19 1	22 19 9	P. B. Street.
0.75 N.E.—N.E. cor. sec. 10	2	13	4	1911.4	22 31.5	22 30 3	"
0 75 N.E.— " " 10	2	13	4	1911.4	22 32.5	22 31 3	"
Centre of E. by section 26	61	13	4	1908.5	27 15 5	27 27.8	G. J. Lonergan.
10.00 S.— N.E. cor. sec. 33	63	13	4	1909.7	27 02 0	27 05.0	"
15.00 W.— " " 11	64	13	4	1909.7	27 18.9	27 19.9	"
11.00 N.— sec. cor. E. by 16	2	14	4	1911 5	22 19.8	22 12.9	P. B. Street.
11.00 N.— " " 16	2	14	4	1911.5	22 16.7	22 17.8	"
12.00 S.—N.E. cor. sec. 9	2	14	4	1911 5	22 06.1	22 05.2	"
Athabaska River Below Boiler Rapids	87	14	4	1910.4	31 56.1	31 58.2	C. Engler.
47.66 N.—N.E. cor. sec. 33	1	15	4	1911 9	22 58 3	22 53.8	P. B. Street.
12 00 S. " " 11	61	15	4	1909.7	26 48 6	26 49.6	G. J. Lonergan.
42 69 W.— " " 32	88	15	4	1911.9	31 13.9		G. H. Blanchet.
50 00 W.— " " 31	88	15	4	1911.9	31 09.0		"
45.00 S.— " " 5	26	16	4	1911 7	24 02.9	24 00 5	C. Rinfret.
At ¼ sec. cor. E. by sec. 18	46	16	4	1910.9	25 26 6	25 29.0	P. R. A. Belanger
63 90 W.—N.E. cor. sec. 31	88	16	4	1912.0	29 48 5	29 45.8	G. H. Blanchet.
At N.E. cor. sec. 24	26	17	4	1911.7	24 22.0		C. Rinfret.
43.22 E.—N.E. cor. sec. 23	41	17	4	1909.6	25 01.0		H. S. Holcroft.
43.22 " " 23	41	17	4	1909 6	24 53.1	24 58.2	"
38.00 W. 8.00 N.—N.E. cor. 13	41	17	4	1909 6	24 47.9	25 01.0	"
At N.E. cor. sec. 3	42	17	4	1909 6	25 09 4	25 08.5	"
" 3	42	17	4	1909.6	24 52.7	25 01 8	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					′	′	
38.24 W.—N.E. cor. sec. 21.....	42	17	4	1909.6	24 58.2	24 57.1	H. S. Holcroft.
32.00 W. 65.00 N.—N.E. cor. 21.....	42	17	4	1909.6	25 04.4	25 03.3	"
32.00 W. 65.00 N. " 21 ..	42	17	4	1909.6	24 51.6	25 00.5	"
8.00 W.—N.E. cor. sec. 7.....	43	17	4	1909.5	24 55.4	25 03.1	"
8.00 W. " " 7.....	43	17	4	1909.5	25 06.4	25 11.6	"
4.00 N.—N.E. cor. sec. 33.....	64	17	4	1911.6	28 00.8	28 02.3	C. F. Miles.
10.00 S.— " " 23	68	17	4	1910.7	27 37.9	27 35.9	G. J. Lonergan.
10.00 N.— " " 34	68	17	4	1910.7	27 31.7	27 31.7	"
Athabaska R., Grand Rapids Is....	84	17	4	1910.4	31 23.6	31 30.5	C. Engler.
"	84	17	4	1910.4	31 38.8	31 40.7	"
"	84	17	4	1910.4	31 26.1	31 31.0	J. A. Coté
"	84	17	4	1910.4	31 36.3	31 41.2	"
"	84	17	4	1910.4	31 33.0	31 37.1	"
"	84	17	4	1910.4	31 32.0	31 35.1	C. Engler.
"	84	17	4	1910.4	31 43.7	31 39.8	"
"	84	17	4	1910.4	31 29.1	31 41.2	"
"	84	17	4	1910.4	31 24.2	31 34.3	"
" . .	84	17	4	1910.4	31 25.1	31 29.2	"
" ...	84	17	4	1910.7	31 41.0	31 40.2	"
9.00 W. 17.00 N.—N.E. cor. sec. 21	43	18	4	1909.5	26 41.5	26 55.1	H. S. Holcroft.
At N.E. cor. sec. 20.....	45	18	4	1909.5	26 07.0	26 06.6	"
" 20.....	45	18	4	1909.5	25 44.6	25 52.2	"
15.00 S.—N.E. cor sec. 4.....	62	18	4	1911.6	27 00.5	26 58.4	C. F. Miles.
45.00 N.—S.E. cor. sec. 25...	62	18	4	1910.8	27 24.7	27 23.4	G. J. Lonergan.
10.00 N.—N. E. cor. sec. 21.....	67	18	4	1910.7	26 41.6	26 41.6	"
"Bull's" House H. B. Co's. Warehouse, N. end Buffalo Lake.....	96	18	4	1911.0	28 28.5	28 28.9	J. N. Wallace.
5.00 E.—N. E. cor. sec. 26.....	29	19	4	1908.7	24 55.5	.....	G. J. Lonergan.
47.18 S.— " " 10	44	19	4	1909.7	26 16.2	26 13.2	H. S. Holcroft.
47.18 S.— " " 10.... ...	44	19	4	1909.7	26 16.3	26 19.3	"
10.00 E., 24.00 N. N. E. cor. sec. 30..	44	19	4	1909.4	26 09.9	26 05.8	"
10.00 E., 24.00 N. " 30..	44	19	4	1909.4	25 55.9	26 00.8	"
40.00 E.—S. E. cor. sec. 5.....	50	20	4	1908.5	27 08.9	27 17.4	G. J. Lonergan.
39.00 S.—N. E. cor. sec. 5.	52	20	4	1911.8	27 09.6	27 05.6	R. C. Purser.
At S. E. cor. sec. 5.....	63	20	4	1910.8	28 24.5	28 24.6	G. J. Lonergan.
30.00 S.—N. E. cor. sec. 33	68	20	4	1910.7	28 04.6	28 04.6	"
7.00 N.— " " 20	19	21	4	1911.7	23 36.2	23 36.2	G. A. Bennett.
At N. E. cor. sec. 35	59	21	4	1908.9	27 32.6	.....	G. J. Lonergan.
2.00 N.—1/4 cor. W. by sec. 31.....	62	21	4	1910.8	28 16.7	28 15.8	"
At N. E. cor. sec. 33.....	62	21	4	1910.8	28 59.7	28 59.8	"
50.00 W.—N. E. cor. sec. 19.....	63	21	4	1910.8	28 47.5	. . . .	"
10.00 E.— " " 19.	62	22	4	1910.8	28 55.5	29 00.1	"
10.00 N.—S. E. " 16.....	63	22	4	1910.8	28 44.1	28 45.7	"
71.11 N. 67.63 E.—N. E. cor. sec. 7..	66	22	4	1910.8	28 14.1	28 07.8	J. A. Coté.
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 00.0	28 01.7	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 10.0	28 05.7	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 03.5	28 03.2	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 12.7	28 11.9	"
71.11 N, 67.63 E.— " 7..	66	22	4	1910.8	28 04.0	28 07.7	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.9	28 11.5	28 10.9	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.9	28 11.8	28 07.2	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.9	28 04.9	28 08.3	"
71.11 N. 71.01 E.—N. E. cor. sec. 7..	66	22	4	1910.4	28 04.1	. . . .	C. Engler.
71.11 N. 71.01 E.— " 7..	66	22	4	1910.4	27 51.9	27 58.8	"
71.11 N. 71.01 E.— " 7..	66	22	4	1910.4	28 01.5	28 07.4	"
71.11 N. 67.63 E.—N. E. cor. sec. 7..	66	22	4	1910.9	28 14.8	28 11.2	J. A. Coté.
71.11 N. 67.63 E.— " 7..	66	22	4	1910.9	28 07.3	28 06.7	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 12.0	28 11.1	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	27 59.6	28 05.2	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 13.2	28 08.9	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 01.9	28 03.6	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 13.7	28 10.4	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 04.1	28 06.8	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 12.9	28 11.6	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	27 59.3	28 02.0	"
71.11 N. 67.63 E.— " 7..	66	22	4	1910.8	28 11.9	28 06.6	"

TABLE No. 4—*Continued.*

Place	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
71.11 N. 67.63 E.—N. E. cor. sec. 7	66	22	4	1910 8	27 58.7	28 00.4	J. A. Coté.
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 12.0	28 08.4	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 07 3	28 [illegible] 7	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 15.9	28 13.4	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 [illegible] 5	28 09.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 12.3	28 13.7	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 [illegible] 2	28 [illegible] 8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 12.6	28 08.0	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 06.5	28 07.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 14 0	28 [illegible] 4	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 [illegible] 5	28 11.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 11 7	28 09.1	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 05.5	28 09.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 8	28 10.2	28 15.3	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 03.8	28 [illegible] 9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 11.7	28 09.8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	27 [illegible] 9	28 [illegible] 0	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 12.7	28 13.8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 8	28 03.2	28 06 8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 07.5	28 06.6	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 8	28 02.2	28 05.3	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 10.3	28 13 9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.8	28 02 3	28 04 4	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 07 4	28 14.8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 [illegible] 2	28 04 6	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 04.1	28 09.5	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 03.9	28 05.3	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 11.6	28 10.0	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 06.5	28 07.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 13 0	28 09.4	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 03.2	28 05.6	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 10.5	28 05.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910 9	28 03.5	28 04.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 09.5	28 05.9	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	27 59 4	28 02.8	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 13.5	28 09.9	"
71.11 N. 67.63 E.—N.E. cor. sec. 7	66	22	4	1910.9	28 [illegible] 5	28 05.9	J. A. Coté.
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 12.9	28 09 3	"
71.11 N. 67.63 E.— " 7	66	22	4	1910.9	28 05.3	28 03.7	"
10 00 N.—S. E. cor. sec. 15	69	23	4	1910.7	28 16.1	28 18.1	G. J. Lonergan.
E. By. sec. 33	61	24	4	1908 7	28 40.4	28 47.9	"
40 00 E.—N. E. cor. sec. 11	36	25	4	1911.7	25 31.9	25 32.9	G. A. Bennett.
40 00 E.— " 11	36	25	4	1911.7	25 26 8	25 25.8	"
40 00 E.— " 11	36	25	4	1911.7	25 31.2	25 28.2	"
10 00 S.—N. W. " 19	62	25	4	1909.9	27 [illegible]	27 17.0	G. J. Lonergan.
10 00 N.—N. E. " 26	62	26	4	1909.9	27 12.1	27 12.7	"
10 00 N.—S. E. " 1	63	26	4	1909.9	27 [illegible]	27 02.0	"
50 00 S.—N. E. " 29	50	27	4	1911 5	27 44.2	27 41.3	"
10 00 N.—S. E. " 31	53	27	4	1910 4	27 49.7	27 54.6	"
17 00 S.—N. E. " 7	7	29	4	1911 8	24 37.5	24 33.5	P. B. Street.
61 40 S.— " " 11	3	30	4	1908 8	23 28.2	23 41.0	W. H. Young.
31 00 W.—[illegible] cor. S. By sec. 1	7	30	4	1911.8	24 48.5	24 45 5	P. B. Street.
Travers of Fish L[illegible] in sec. 36	4	1	5	1911.8	24 37.2	24 33.2	"
35.00 W.—N.E. cor. sec. 7	5	1	5	1910 9	25 39.8	25 40.2	J. L. Lang.
36.00 N.— " 19	5	1	5	1910 9	25 [illegible] 8	25 53.0	"
At N.E. cor. sec. 9	13	1	5	1909 5	24 00.2	24 06.8	W. A. Scott.
45.00 E.—N.E. cor. sec. 8	13	1	5	1909.5	24 05.9	24 00.0	"
50 00 S.— " 17	13	1	5	1909.5	24 01.4	24 08.0	"
55 00 E.— " 7	13	1	5	1909 5	24 04.8	24 01.4	"
At " 8	13	1	5	1909.5	24 01.2	24 00.8	"
35 00 E.— " 8	13	1	5	1909.5	23 57 7	24 02.8	"
At " 19	13	1	5	1909 5	23 42.0	23 41.6	"
30 00 N.— " 19	13	1	5	1909.4	24 00 6	23 57.0	"
62 00 W.— " 7	13	1	5	1909.5	23 58.3	24 04.4	"
10.00 S.— " 18	13	1	5	1909.5	24 06.8	24 03.4	"
35 21 E.— " 31	80	1	5	1910 6	29 29.7	29 30.8	A. H. Hawkins.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912·0	
					° ′	′ ″	
At N.E. cor. sec. 36	86	1	5	1910.7	30 08.2	30 07 0	A. H. Hawkins.
15 00 S.— " 36	81	1	5	1911.4	29 51.9	29 54.7	T. H. Plankett.
At ¼ Post—E. by. sec 1	83	1	5	1911.4	29 57.8	29 58.6	"
33 00 N.—N.E. cor. sec. 12	84	1	5	1911.4	30 51.3	30 52.1	"
At ¼ Post—E. by. sec. 24	84	1	5	1911.4	30 43.6	30 42.4	"
78 50 W.—N.E. cor. sec. 36	84	1	5	1911.3	29 48 9	29 49 3	A. H. Hawkins.
12 00 S.— " 36	85	1	5	1911.4	29 56 1	29 55.5	T. H. Plankett
3 00 S.— " 13	87	1	5	1911.4	30 33 7	30 35.1	"
At ¼ Post E. by. sec. 24	88	1	5	1911 5	30 44.1	30 49.2	"
" " 13	90	1	5	1911.5	31 45.6	31 47.7	"
At N.E car sec. 24	91	1	5	1911 5	30 58.1	31 02.2	"
" " 13	92	1	5	1911.5	30 33.0	30 32.2	"
10 00 S.—N.E. cor. sec. 24	94	1	5	1911 5	30 33.2	30 36 4	"
20.00 S. ¼ Post E. by. sec. 36	95	1	5	1911.5	31 29.0	31 31.2	"
10 00 S. " " 24	96	1	5	1911.5	30 46.2	30 45.4	"
5 00 N.—N.E. cor. sec. 24	99	1	5	1911.6	30 44.0		"
20 00 S.— " 1	100	1	5	1911 6	30 58 0	30 57.9	"
At ¼ Post—E. by. sec. 36	100	1	5	1911 6	31 26.4	31 25.3	"
" " 25	103	1	5	1911.6	31 45 1	31 42 6	"
10 00 S. ¼ Post E. by sec. 13	104	1	5	1911 6	32 01 9	31 59.4	"
15 00 N.—N.E. cor. sec. 36	108	1	5	1911 6	32 54 5		"
" " 13	108	1	5	1911.6	33 00 1	32 57.6	"
5 68 S—¼ Post E. by sec. 13	109	1	5	1911.6	33 01 3	32 58.1	"
20.00 N.— " 24	110	1	5	1911.7	32 46 8	32 43 8	"
6 00 N.— " 12	110	1	5	1911.7	33 08.4	33 04.4	"
60 00 S.—N.E. cor. sec. 1	13	2	5	1909.5	24 09.3	24 13.9	W. A. Scott.
20 00 S.— " 12	13	2	5	1909.5	24 10.9	24 11.5	"
60.00 S.— " 12	13	2	5	1909.5	23 59.5	24 12.1	"
75 00 S.— " 13	13	2	5	1909.5	24 08.0	24 09.6	"
At " 12	13	2	5	1909.5	23 54.1		"
32 00 S.— " 5	13	2	5	1909.9	24 02.4	24 02.2	"
62 00 S.— " 8	13	2	5	1909.9	24 03.9	24 06.5	"
15.00 S.— " 8	13	2	5	1909.9	24 05.3		"
60.00 N.—S.E. cor. sec. 30	14	2	5	1909.5	23 14.9		Jas. Warren.
36 00 N.—N.W. " 19	14	2	5	1909.5	23 22.6	23 16 2	"
At N.E. " 31	14	2	5	1909.5	23 15.7	23 20.3	"
50 00 N.—S.E. " 31	14	2	5	1909.5	23 20.8		"
25 00 N.—N.E. " 13	14	2	5	1909 4	23 44.6	23 49.9	"
35 00 E.—N.W. " 20	14	2	5	1909.4	23 15.9	23 23.8	"
15 00 N.—S.E. " 24	14	2	5	1909 4	23 11 8	23 14.7	"
4.00 E.—N.W " 19	14	2	5	1909.4	23 17.5	23 21.4	"
45 00 W.—N.E. " 32	14	2	5	1909.5	23 17.6	23 25 2	"
50 00 N.—N.W. " 19	14	2	5	1909.5	23 11.6	23 20.2	"
At N.E " 31	14	2	5	1909.5	23 26.8	23 25.4	"
50 00 N.—N.W. " 19	14	2	5	1909.5	23 33.9	23 28.5	"
10 00 S.— " 18	15	2	5	1909 5	23 13.0	23 17.6	"
10 00 S.— " 18	15	2	5	1909.5	23 39.4	23 34.5	"
35 00 S.— " 7	15	2	5	1909.5	23 33.0	23 29 6	"
40 00 N.—N.W. cor. sec. 1	15	2	5	1909 5	23 28·3		Jas. Warren.
At N.E. cor. sec. 35	80	2	5	1910 6	29 29·7	29 32·8	A. H. Hawkins.
79 00 E.—N.E. cor. sec. 35	80	2	5	1910 6	29 07·3		"
35·00 W.— " 36	84	2	5	1911.3	30 24·2	30 25·3	"
43·00 W.— " 35	84	2	5	1911.3	30 24·2	30 27·3	"
47 50 W.— " 33	84	2	5	1911.4	30 10·8	30 10·6	"
5 00 W.— " 31	84	2	5	1911.4	30 27·5	30 25·3	"
36·00 W.— " 36	84	2	5	1911.3	30 09·0	30 11·1	"
36 00 W.— " 36	84	2	5	1911.3	30 24·0	30 25·1	"
69 79 W.— " 35	84	2	5	1911.3	30 05·1	30 09·2	"
36 67 W.— " 33	84	2	5	1911.4	30 10·5	30 10·3	"
69·83 W.— " 31	84	2	5	1911.4	30 03·2	30 01·0	"
24·80 S.— " 22	6	3	5	1908.5	24 41·9	24 49·2	W. H. Young.
At N.E cor. sec. 7	9	3	5	1909.6	23 54·0	24 00·1	W. A. Scott.
" 6	9	3	5	1909.6	23 51·5	24 00·6	"
40·00 N.—N.E. cor. sec. 6	9	3	5	1909.6	24 00 5	23 52 1	"
20 00 S.— " 6	9	3	5	1909 5	24 01·2	24 02·1	"
At N.E. cor. sec. 30	10	3	5	1909.7	23 45 8	23 44 8	"

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
65·00 N.—N.E. cor. sec. 19	10	3	5	1909.7	24 00·5	23 57·5	W. A. Scott.
45 00 N.— " 19	10	3	5	1909 7	23 59·6	23 59·6	"
20·00 N.— " 19	10	3	5	1909.7	24 00·7	23 58·7	"
70·00 N.— " 18	10	3	5	1909.7	23 51·7	24 03·7	"
50·00 N.— " 7	10	3	5	1909.6	23 49 8	24 00 1	"
50·00 N.— " 18	10	3	5	1909 7	23 59·3	23 53·3	"
30·00 N.— " 7	10	3	5	1909 6	23 54 8	23 .. 1	"
21·00 W.— " 7	10	3	5	1909 6	23 56·0	24 05·3	"
36·00 S.— " 36	12	3	5	1909 9	24 04 8	24 08 4	"
At N.E. cor. sec. 25	12	3	5	1909.9	24 08·2	24 07·8	"
12·00 S.—N.E. cor. sec. 36	12	3	5	1909.9	24 08·5	24 07 1	"
30 00 N.— " 30	13	3	5	1909.5	23 48·5	23 41 9	"
At N.E. cor. sec. 29	13	3	5	1909 5	23 38 3	23 46 7	"
40·00 W.—N.E. cor. sec. 31	13	3	5	1909 5	23 49 2	23 44·3	"
40 00 N.— " 29	13	3	5	1909 5	23 39·0	23 46·4	"
At N.E. cor. sec. 29	13	3	5	1909.5	23 45 7	23 32·6	"
" 34	13	3	5	1909 5	23 38 2	23 44 2	"
7·00 N.—N.E. cor. sec. 25	14	3	5	1909 5	23 57 0	23 53·6	Jas Warren.
At N.E. cor. sec. 25	15	3	5	1909.5	23 30 4	23 36 0	
10·00 N.—S.E. cor. sec. 36	15	3	5	1909 5	24 50·9	24 58 5	
10·00 S.—N.E. cor. sec. 5	63	3	5	1911 3	27 58 1	27 55 5	G. J. Lonergan.
64·49 E.— " 32	80	3	5	1910 6	31 32 6	31 35 7	A. H Hawkins
66·00 E.— " 34	80	3	5	1910 6	31 20·6	31 27 7	"
38·48 W.— " 36	84	3	5	1911 4	30 00 4	29 58·2	"
10·00 W.— " 35	84	3	5	1911 4	30 15 8	30 16 6	"
71·00 W.— " 32	84	3	5	1911 4	31 04·1	31 03 9	"
At N.E. cor. sec. 34	5	4	5	1909.6	24 31 6	..	W. H Young.
44·00 S.—N.E. cor. sec. 35	5	4	5	1910 8	25 14·3	25 15·4	J. L. Lang.
12 00 S.— " 26	5	4	5	1910 8	25 00·7	25 01 8	"
60·00 S.— " 26	5	4	5	1910 8	24 59 0	25 02 1	"
10·00 W.— " 23	5	4	5	1910 8	25 07·4	25 08 5	"
40·00 W.— " 23	5	4	5	1910.8	24 58·0	..	"
10·00 S.— " 27	5	4	5	1910.8	24 59 6	25 01 7	"
20 00 N.— " 22	5	4	5	1910 8	25 08 0	25 07 1	"
20 00 E.— " 22	5	4	5	1910 8	25 07·5	25 08·6	"
45·00 E.— " 21	5	4	5	1910 8	25 03 6	25 04·7	"
35 00W.— " 21	5	4	5	1910.8	25 02·2	25 01 3	"
35·00 N.— " 20	5	4	5	1910.8	24 59 5	24 59 6	"
70·00 N.— " 20	5	4	5	1910 8	25 00 9	24 59 6	
39 00 W.— " 19	5	4	5	1911 6	24 23·4	24 23 9	P. B. Street.
12 50 N.— " 17	5	4	5	1911 7	24 15·2	24 12 4	
At N.E. cor. sec. 24	5	4	5	1908 5	24 45·7	24 53 2	W. H. Young.
24·00 N.—N.E. cor. sec 20	6	4	5	1909.7	24 36 5	24 33 5	
60 00 N.— " 20	6	4	5	1909.7	24 13 8	24 15 8	
70·00 E.— " 32	6	4	5	1910.7	24 48·6	24 51 6	J. L. Lang.
60 00 W.— " 36	6	4	5	1910 7	24 51·4	24 55 4	"
40·00 W.— " 25	6	4	5	1910 7	24 50 2	24 52 2	"
At N.E. cor. sec. 34	6	4	5	1910 7	24 50·6	24 50 0	"
40·00 W.—N.E. cor. sec. 33	6	4	5	1910.7	24 48·5	24 48 5	"
60 00 W.— " 34	6	4	5	1910.7	24 49·6	24 47 0	"
20·00 S.— " 27	6	4	5	1910 7	24 50·8	24 52 8	"
10 00 N.— " 26	6	4	5	1910 7	24 52·1	24 53 1	"
50·00 S.— " 26	6	4	5	1910.7	24 54 5	24 53 5	"
5·00 N.— " 11	6	4	5	1910 8	25 04·9	25 09 0	"
40·00 N.—S.E. cor, sec. 3	6	4	5	1910 8	24 59·0	24 59 7	"
At N.E. cor. sec. 4	6	4	9	1910 8	25 02·6	25 02 3	"
25·00 S.—N.E. cor. sec. 19	7	4	5	1910.6	24 41·1	24 43 2	"
10·00 S.— " 18	7	4	5	1910.6	24 42·6	24 44 7	"
20 00 N.— " 7	7	4	5	1910 6	24 41·1	24 49 2	"
12 00 E.— " 7	7	4	5	1910.6	24 43·1	24 46 2	"
40·00 E.— " 7	7	4	5	1910.6	24 44·3	24 47 4	"
5·00 S.— " 8	7	4	5	1910 6	24 45 3	24 47 4	
60.00 S.—N.E. cor. sec. 6	7	4	5	1910 7	24 45.7	24 45 7	J. L. Lang.
19 00 W.— " 31	8	4	5	1909 8	24 00 0	..	"
55.00 W.— " 31	8	4	5	1909 8	23 5 9	24 01 6	"
40 00 W.— " 31	8	4	5	1909.8	24 01.7		"
50.00 W.— " 33	8	4	5	1910 7	24 00 1	..	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer	Date.	Declination.		Observer.
					Obsd.	Reduced to 1912.0	
					° ′	°	
35.00 W.—N.E. cor. sec. 33.....	8	4	5	1909.7	24 09.9	.....	J. L. Lang.
50.00 W.— " 34.....	8	4	5	1909.7	24 01.6	24 05.6	"
At N.E. cor. sec. 34	8	4	5	1909.7	24 01.5	.....	"
50.00 N.—N.E. cor. sec. 20.....	8	4	5	1909.7	24 02.1	24 11.1	"
20.00 W.— " 32	8	4	5	1909.7	24 00.1	.....	"
70.00 N.— " 29	8	4	5	1909.8	24 02.0	.....	"
70.00 N.— " 29	8	4	5	1909.8	24 01.8	.....	"
At N.E. cor. sec. 30	8	4	5	1909.6	24 06.6	24 04.5	W. A. Scott.
72.00 N.—N.E. cor. sec. 29	8	4	5	1909.8	24 00.9	24 05.6	"
40.00 N.— " 29	8	4	5	1909.8	24 03.5	24 01.2	"
10.00 N.— " 29	8	4	5	1909.8	24 00.5	24 07.2	"
10.00 N.— " 29.....	8	4	5	1909.8	24 02.8	23 57.5	"
64.00 W.— " 31.....	8	4	5	1909.8	23 59.3	24 08.0	"
64.00 W.— " 31.....	8	4	5	1909.8	24 01.5	23 58.2	"
35.00 W.— " 34	8	4	5	1909.7	24 02.3	24 10.3	"
18.00 W.— " 34	8	4	5	1909.7	24 04.3	24 04.3	"
30.00 W.— " 33	8	4	5	1909.7	24 05.0	24 11.0	"
20.00 W.— " 33	8	4	5	1909.7	24 04.0	24 04.0	"
40.00 N. " 7	9	4	5	1909.8	24 02.2	24 12.9	"
20.00 N.— " 7	9	4	5	1909.8	24 01.5	23 59.2	"
52.00 N.— " 6.....	9	4	5	1909.8	24 03.2	24 10.9	"
16.00 N. N.E. cor. sec. 6.....	9	4	5	1909.8	24 01.6	23 58.3	"
29.00 N.— " 18.....	9	4	5	1909.8	24 01.3	24 08.0	"
At " 18	9	4	5	1909.8	24 01.6	24 01.3	"
53.00 N.— " 18.....	9	4	5	1909.8	24 01.6	24 04.3	"
53.00 N.— " 18.....	9	4	5	1909.8	24 01.0	24 02.7	"
41.00 S.— " 1.....	9	4	5	1909.6	24 09.6	24 11.5	"
At " 33.....	9	4	5	1909.9	24 05.6	24 06.6	"
70.00 S.— " 6.....	9	4	5	1909.8	24 02.5	23 59.2	"
51.00 S.— " 6.....	9	4	5	1909.8	24 00.5	24 07.2	"
11.00 S.— " 6.....	9	4	5	1909.8	24 03.1	23 56.8	"
30.00 S.— " 6.....	9	4	5	1909.8	24 03.5	24 08.2	"
35.00 E.— " 23.....	9	4	5	1909.6	24 04.0	24 02.1	"
30.00 N.— " 25.....	9	4	5	1909.6	24 02.6	23 59.7	"
55.00 N.— " 25.....	9	4	5	1909.6	24 00.3	24 02.4	"
At " 36.....	9	4	5	1909.6	24 04.7	24 02.8	"
40.00 W.— " 36.....	9	4	5	1909.6	23 57.9	24 07.0	"
30.00 N.— " 25	9	4	5	1909.6	23 59.1	24 10.2	"
At " 25.....	9	4	5	1909.6	24 01.6	23 59.7	"
20.00 N.— " 26.....	9	4	5	1909.6	24 03.2	.....	"
At " 26.....	9	4	5	1909.6	24 01.1	24 09.2	"
16.00 N.— " 6.....	9	4	5	1909.8	24 02.5	24 09.2	"
65.00 W.— " 36.....	9	4	5	1909.6	23 56.0	23 55.1	"
20.00 W.— " 35	9	4	5	1901.6	23 56.2	24 08.3	"
40.00 W.— " 33.....	9	4	5	1909.9	24 03.8	24 00.8	"
30.00 W.— " 33.....	9	4	5	1909.9	24 03.6	24 09.6	"
11.00 W.— " 33.....	9	4	5	1909.9	24 05.4	24 03.4	"
60.00 W. N.E. cor. sec. 33.....	9	4	5	1909.9	24 05.1	24 10.1	"
25.00 W.— " 35.....	9	4	5	1909.8	24 06.0	24 14.8	"
30.00 N.— " 20.....	9	4	5	1909.8	24 03.2	24 09.9	"
30.00 N.— " 20.....	9	4	5	1909.8	24 02.5	23 57.2	"
10.00 W.— " 34.....	9	4	5	1909.8	24 05.8	.....	"
12.00 N.— " 20.....	9	4	5	1909.8	24 01.0	23 55.7	"
18.00 N.— " 17.....	9	4	5	1909.8	24 03.8	.....	"
30.00 N.— " 20.....	9	4	5	1909.8	24 04.3	24 09.0	"
18.00 N.— " 17	9	4	5	1909.8	24 02.6	.....	"
8.00 N.— " 19.....	9	4	5	1909.8	24 02.7	24 01.4	"
8.00 N.— " 17.....	9	4	5	1909.8	24 02.8	24 06.5	"
43.00 N.— " 19.....	9	4	5	1909.8	24 03.4	24 10.1	"
9.00 E.— " 19	9	4	5	1909.8	24 00.1	24 05.8	"
At " 12.....	9	4	5	1909.6	24 10.5	24 03.6	"
50.00 W.— " 12.....	9	4	5	1909.6	23 53.7	24 00.8	"
40.00 N.— " 13.....	9	4	5	1909.6	24 00.9	24 10.0	"
70.00 N.— " 13.....	9	4	5	1909.6	23 59.9	23 53.0	"
20.00 N.— " 13	9	4	5	1909.6	24 06.4	24 00.5	"
60.00 N.— " 12.....	9	4	5	1909.6	24 01.5	24 05.6	"
At " 23.....	9	4	5	1909.6	24 02.4	24 06.5	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
60.00 W.—N.E. cor. sec. 11	9	4	5	1909.6	24 04.6	23 56.7	W. A. Sec.tt.
At " 11	9	4	5	1909.6	24 07 6	23 57.7	"
40 00 N.— " 11	9	4	5	1909.6	23 59.2	24 07.3	"
40.00 N.— " 23	9	4	5	1909 6	24 03.2	23 54.3	"
At " 23	9	4	5	1909.6	24 04 3	23 57.4	"
65.00 E.— " 23	9	4	5	1909 6	23 59.0	24 05.1	"
At N.E. cor., sec. 1	9	4	5	1909 6	24 07 2		"
10.00 N.—N.E. cor., sec. 12	9	4	5	1909 6	24 04.3		"
50 00 N.— " 1	9	4	5	1909.6	23 59.6		"
12.00 N.— " 32	9	4	5	1911.5	24 02.4	24 06.6	"
At " 32	9	4	5	1911 5	23 59.5	24 04.7	"
20.00 N.— " 31	9	4	5	1911 5	23 55.0	24 01.2	"
41 00 N.— " 31	9	4	5	1911 5	23 56.1	24 00.3	"
58.00 N.— " 31	9	4	5	1911.5	24 01.1	24 04.3	"
60.00 N.— " 1	10	4	5	1909.6	24 05.4	24 01.5	"
50.00 N " 12	10	4	5	1909 6	23 54 8	24 05.9	"
56.00 S.— " 4	10	4	5	1909.9	24 04 6	24 10.6	"
At " 12	10	4	5	1909.6	24 04.8	24 01.9	"
40 00 N.— " 12	10	4	5	1909.6	24 08 1		"
20.00 N " 24	10	4	5	1909 7	24 01.4	24 01.2	"
At " 9	10	4	5	1909 9	24 04.0	24 04.0	"
45.00 N. " 4	10	4	5	1909.9	24 04.3	24 09.3	"
At " 9	10	4	5	1909.9	24 04.1	24 11 1	"
21 00 N.— " 4	10	4	5	1909.9	24 02.6	24 00.6	"
25.00 N.— " 25	10	4	5	1909 7	23 53.7	24 04 5	"
60.00 N.— " 24	10	4	5	1909 7	23 52.3	24 02.1	"
At " 25	10	4	5	1909.7	24 08 7	24 07.5	"
2.00 S.— " 3	10	4	5	1909 9	24 06.5	24 14.5	"
2 00 S.— " 3	10	4	5	1909.9	24 07.1	24 06.1	"
64.00 S.— " 3	10	4	5	1909 9	24 07.0	24 09.0	"
31.00 S.— " 4	10	4	5	1909 9	24 05.2	24 05.2	"
36.00 N.— " 6	10	4	5	1911.5	24 02.1	24 05.3	"
70.00 N.— " 6	10	4	5	1911.5	23 58 1	24 02.3	"
At N.E. cor., sec. 24	10	4	5	1911.6	23 57.1	23 58 6	"
67.00 N.—N.E. cor. sec. 30	10	4	5	1911.6	24 03.4	24 01.9	"
25.00 W.— " 33	11	4	5	1910.7	23 46.2	23 50.2	"
40.50 W.— " 33	11	4	5	1910.7	23 44.6	23 47.2	"
41.00 S.— " 33	11	4	5	1910.7	23 50.8	23 50.8	"
0.89 N.— " 21	11	4	5	1910.7	23 42.3	23 42.3	"
38 25 S.— " 22	11	4	5	1910.7	23 47.6	23 47.1	"
29 00 S.— " 10	11	4	5	1910.7	24 04.7	24 02.1	"
4 00 N.— " 9	11	4	5	1910.8	24 00.8		"
20.00 S. " 4	11	4	5	1910.8	23 52 2	23 57.3	"
64.35 E.— " 5	12	4	5	1910.7	23 39.6	23 39.6	"
8.65 S.— " 5	12	4	5	1910.7	23 49.7	23 51 7	"
20 00 S. " 9	12	4	5	1910 8	23 51.1	23 50.8	"
70.00 N.— " 21	12	4	5	1911 7	23 49.7	23 49.7	"
62 00 N. " 28	12	4	5	1911.7	23 46 9	23 46.9	"
37 00 N.— " 17	12	4	5	1911.7	23 39.1	23 41.3	"
69.00 N. " 7	12	4	5	1911.7	23 39.1	23 38.3	"
At " 19	12	4	5	1911.7	23 35.6	23 35.6	"
48.00 E.— " 19	12	4	5	1911.7	23 46 2	23 45.2	"
6.00 W.— " 20	12	4	5	1911.7	23 46.7	23 44.7	"
50.00 E. " 20	12	4	5	1911 7	23 46.5	23 45.5	"
23 00 N. " 9	12	4	5	1911.7	23 48.1	23 48.1	"
67.00 W.— " 19	12	4	5	1911.7	23 37.2	23 36.2	"
1 00 S.— " 13	12	4	5	1911 7	23 49.6	23 49.6	"
9 00 N.— " 20	12	4	5	1911.7	23 47.1	23 46.1	"
42.00 N.— " 29	12	4	5	1911.7	23 53 5	23 53.5	"
At N.E. cor., sec. 7	13	4	5	1911 8	23 51 9	23 49.9	"
2nd trial line, 30 00 E.-N.E., cor. 31	17	4	5	1911 6	25 15.7	25 16 6	E. S. Martindale.
5 00 S.—N.E. cor., sec. 2	20	4	5	1909.5	24 40.5	24 46.9	Jas. Warren.
50.00 S. " 15	20	4	5	1909 5	25 18.5	25 14.9	"
45.00 W.— " 12	20	4	5	1909 5	24 43.5	24 51.9	"
10 00 N.—S.E. " 11	20	4	5	1909 5	24 53.2	25 00.6	"
65.00 W.—N.E. " 12	20	4	5	1909.5	24 43.4	24 51.8	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
45 28 S.—N E. cor. sec. 7.....	46	4	5	1909.4	26 47.9	26 56.8	L. E. Fontaine.
15 00 W. " " 31	80	4	5	1910.6	29 55.3	30 02.4	A. H. Hawkins.
58.15 E.— " " 32.....	80	4	5	1910 6	30 17.9	30 21.0	"
10 00 W. " " 35	84	4	5	1911 4	30 50.2	30 53.0	"
18 00 W.— " " 32.	84	4	5	1911.4	31 27.5	.....	"
4.30 W. " " 31.....	84	4	5	1911 4	31 31.2	31 32.0	"
48.50 W.— " " 32	84	4	5	1911 4	31 28 6	31 29.4	"
5.00 N.— " " 12	6	5	5	1909.7	23 41.3	23 49.3	W. H. Young.
41 00 N.— " " 1.....	6	5	5	1909 7	24 28 3	.....	"
5.00 N.— " " 12	6	5	5	1909 7	23 43.0	23 41.5	"
20 00 N. " " 26	7	5	5	1910 6	24 42 7	24 47.6	J. L. Lang.
30.00 S.— " " 26	7	5	5	1910.6	24 43.9	24 47.0	"
40 00 N.— " " 16	8	5	5	1910 6	24 45 5	24 52.6	"
78 00 N. " " 16.	8	5	5	1910 6	24 32.1	24 39.2	"
60.00 N.— " " 8	8	5	5	1910.6	24 43 4	24 49.5	"
40.00 N.— " " 17	8	5	5	1910 6	24 41.1	24 48.2	"
5 00 E.— " " 20	8	5	5	1910 6	24 51.2	24 57.3	"
40.00 E.— " " 20	8	5	5	1910.6	24 45.8	24 46.9	"
At " " 21	8	5	5	1910 6	24 40.7	24 46.8	"
20 00 S. N.E. cor. sec. 2.....	8	5	5	1910.6	24 45.1	24 47.2	J. L. Lang.
34 00 W.— " 7.....	8	5	5	1911 5	24 32.5	24 36.7	P. B. Street.
9.00 N.— " 36.....	9	5	5	1911.6	24 09 2	24 07.1	W. A. Scott.
57.00 N.— " 1	10	5	5	1911 6	23 58 8	24 01.7	"
43 00 N.— " 1.....	10	5	5	1911.6	23 56.6	24 04.5	"
45.00 E.— " 12	10	5	5	1911.6	24 01.3	24 03.2	"
75.00 E.— " 12	10	5	5	1911.6	24 00 4	24 03.3	"
61.00 E.— " 12	10	5	5	1911.6	24 07.2	24 05.7	"
46.30 N.— " 12.....	10	5	5	1911.6	24 13.9	24 16.4	"
16 00 N.— " 24	10	5	5	1911.6	23 58.6	23 57.1	"
At " 25	10	5	5	1911 6	23 58 5	23 58.0	"
17 50 S.— " 36.....	11	5	5	1911.8	23 55.7	23 54.7	"
60 00 S.— " 25	11	5	5	1911 8	23 52.7	23 53.7	"
16.00 S.— " 29.....	11	5	5	1911 8	23 49.2	23 46.2	"
13.00 S.— " 13.	11	5	5	1911 8	23 55.2	23 51.2	"
68.00 S.— " 13.....	11	5	5	1911.8	23 54.4	23 51.4	"
37.00 S.— " 12.....	11	5	5	1911.8	23 51.1	23 48.1	"
40.00 S.— " 1.....	11	5	5	1911.8	23 52.5	23 48.3	"
40.00 S.— " 1.....	11	5	5	1911.8	23 56.3	23 52.1	"
20.00 S.— " 36.....	12	5	5	1911.7	23 49.3	23 49.3	"
1 00 S.— " 25.....	12	5	5	1911.7	23 47.9	23 44.9	"
10 00 S.— " 24.....	12	5	5	1911.7	23 49.8	23 46.8	"
43.00 N.— " 36.....	12	5	5	1911 8	23 47.6	23 44.6	"
73.00 S.— " 12.....	12	5	5	1911.8	23 49.0	23 46.0	"
47.00 S.— " 13.....	12	5	5	1911 8	23 51.5	23 48.5	"
14.00 N.— " 1	13	5	5	1911.8	23 49.0	23 46.0	"
At " 12.....	13	5	5	1911 8	23 52.7	25 48 7	"
61 85 S.— " 27	17	5	5	1911.6	25 03.6	25 07.1	E S. Martindale.
50.00 W.— " 33.....	17	5	5	1911.6	25 03.2	25 05.7	"
10 00 E.— " 31	20	5	5	1909.7	25 09 8	25 17.8	Jas. Warren.
60 00 W.— " 31.....	20	5	5	1909.7	25 06.0	25 13.0	"
51.00 W.— " 31.....	20	5	5	1909.7	24 56 9	.....	"
61.56 N.— " 16.....	45	5	5	1909.4	26 48.4	26 58.8	L. E. Fontaine.
65 07 S.— " 31.....	46	5	5	1909.4	26 24.2	26 24.9	"
22 03 S.— " 11.....	47	5	5	1910.5	26 35.7	26 44.1	"
At " 33.....	80	5	5	1910.6	29 43.9	29 50.0	A. H. Hawkins.
29.24 E.— " 34	80	5	5	1910.6	29 44.7	29 50.8	"
79.10 E.— " 34.....	80	5	5	1910.6	29 04.1	30 09.2	"
60.09 E.— " 32.....	80	5	5	1910.6	29 44.0	.....	"
32.03 W.— " 36.....	84	5	5	1911.4	31 20.3	31 19.1	"
64.10 W.— " 35.....	84	5	5	1911.4	31 15.4	31 13.2	"
61.50 W.— " 34.....	84	5	5	1911.4	31 29.5	31 30.3	"
9.00 W.— " 33.....	84	5	5	1911.4	31 16.9	31 16.7	"
38.18 W.— " 36.....	17	6	5	1911.6	25 04.8	25 04.3	E. S. Martindale.
48.80 W.— " 33.....	17	6	5	1911.7	25 11.8	25 12.0	"
65.57 W.— " 31.....	17	6	5	1911.7	25 16.3	25 15.3	"
23.95 S.— " 27.....	17	6	5	1911.8	25 00.0	24 58.0	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′ ″	° ′ ″	
62.39 N.—N.E. cor. sec.	11		17	6	5 1911 8	25 11 1	25 07.4 E. S. Martindale.
58.77 E.— "	22		17	6	5 1911 8	25 00.1	24 56.9 "
36 83 S.— "	18		18	6	5 1911.8	25 19 2	25 16.2 "
31 23 E.— "	7		18	6	5 1911.8	25 15 1	25 12 1 "
4.00 E.— "	34		20	6	5 1909.8	25 06 0	25 12.7 Jas. Warren.
20.00 W.— "	35		20	6	5 1909.8	25 12 2	25 10 9 "
4.00 E.— "	34		20	6	5 1909.8	25 10.0	25 15.7 "
10.00 E.— "	35		20	6	5 1909.7	24 58 4	25 03.4 "
16.00 W.— "	35		20	6	5 1909.8	25 03 9	.... "
32.00 W.— "	33		20	6	5 1909.8	25 08.2	25 15 9 "
68.00 W.— "	32		20	6	5 1909.8	25 06.6	25 08 3 "
30.00 W.— "	32		20	6	5 1909.8	25 07.0	25 09 7 "
8.00 W.— "	31		20	6	5 1909.8	25 11 3	25 14 0 "
At "	13		21	6	5 1911 5	25 15.6	25 14 7 C. M. Walker.
50.00 E.— "	32		21	6	5 1911 5	25 33.0	25 33 2 "
At "	6		22	6	5 1911.5	25 29 8	25 32 0 "
At "	4		22	6	5 1911.6	25 34 9	25 52 8 "
10.00 S.— "	1		22	6	5 1911.7	25 28.3	25 25 5 "
41.00 N.— "	8		22	6	5 1911.6	25 32.5	25 32 4 "
10.00 S.— "	18		22	6	5 1911.6	25 29.8	25 29.3 "
40.00 N.— "	15		22	6	5 1911 7	25 23.7	25 16 7 "
62.00 N.— "	24		22	6	5 1911 7	25 19.5	25 15.5 "
At "	28		22	6	5 1911.7	25 17.2	25 13.2 "
24.00 N.— "	24		22	6	5 1911 8	25 12.2	25 09 2 "
10.00 W.— "	36		22	6	5 1911 9	25 37 4	25 34 9 "
62.50 W.— "	33		22	6	5 1911.9	25 33 6	25 29.1 "
48.75 W.— "	33		23	6	5 1911 0	24 58 3	24 57 2 J. R. Akins.
62.50 W.— "	34		23	6	5 1910.9	24 57.9	24 58.2 "
40.00 N.— "	8		23	6	5 1911.8	25 20.8	25 19 8 C. M. Walker.
At "	5		23	6	5 1911.8	25 35.6	25 30 4 "
40.00 N.— "	4		23	6	5 1911 8	25 38 2	25 33.0 "
24.06 S.—N.E. cor. sec.	30		24	6	5 1910 9	24 53 7	24 49 1 J. R. Akins.
47 00 E.— "	20		24	6	5 1910 9	24 55 2	.... "
5.90 W.— "	7		24	6	5 1910 9	24 59 2	24 59 6 "
26.50 S.— "	7		24	6	5 1910.9	24 57 9	24 57.3 "
50.00 S.— "	21		24	6	5 1910.9	24 53 6	25 00 0 "
25 00 E.— "	9		24	6	5 1910 9	24 55 5	24 54 9 "
60.00 S.— "	6		24	6	5 1910.9	24 42 4	24 42 8 "
56 00 S.— "	4		24	6	5 1910 9	24 52 8	25 00 2 "
71.25 S.— "	22		24	6	5 1910.9	24 53.0	24 53.4 "
7.00 S.— "	3		24	6	5 1910 9	24 52 9	24 52 1 "
24.25 S.— "	14		24	6	5 1910 9	24 52.0	24 51 2 "
62.25 S.— "	11		24	6	5 1910.9	24 54 7	24 55.9 "
23.00 S.— "	2		24	6	5 1910.9	24 51 2	24 51 4 "
30.46 S.— "	35		45	6	5 1909 4	26 57 0	27 05 9 L. E. Fontaine.
5.11 S.— "	20		18	6	5 1910 5	26 13 6	26 23 4 "
6.42 S.—¼ post E. By. sec.	28		48	6	5 1911 6	26 23.9	26 23 4 "
62 54 W.—N.E. cor. sec.	31		80	6	5 1910 5	30 08 8	30 13 2 A. H. Hawkins.
34 10 E.— "	34		80	6	5 1910.6	30 03 9	30 09 0 "
28.00 W.— "	35		84	6	5 1911 4	30 35 0	30 39 8 "
30.50 W.— "	33		84	6	5 1911 4	30 00 6	30 03 0 "
57.00 W.— "	31		84	6	5 1911 4	30 35 4	30 35.8 "
52 49 W.— "	34		108	6	5 1910 2	32 37 2	32 41 3 A. W. Ponton.
52 49 W.— "	34		108	6	5 1910 2	32 30 2	32 38 3 "
52 49 W.— "	34		108	6	5 1910 2	32 29 3	32 38 4 "
52 49 W.— "	34		108	6	5 1910 2	32 28 5	32 34 6 "
52 49 W.— "	34		108	6	5 1910 2	32 34 5	32 34 6 "
52 49 W.— "	34		108	6	5 1910 2	32 38 3	32 35 4 "
52 49 W.— "	34		108	6	5 1910 2	32 39 4	32 39 5 "
52 49 W.— "	34		108	6	5 1910 2	32 35 4	32 41 5 "
52 49 W.— "	34		108	6	5 1910 2	32 29 4	32 39 5 "
52 49 W.— "	34		108	6	5 1910 2	32 26 8	32 32 9 "
52 49 W.— "	34		108	6	5 1910 2	32 40 7	32 38 8 "
52.49 W.— "	34		108	6	5 1910 2	32 39 6	32 38.7 "
52 49 W.— "	34		108	6	5 1910 2	32 25 7	32 29 8 "
30 63 N.—N.E. cor. sec.	12		18	7	5 1911.7	25 13 9	25 13.9 E. S. Martindale.
68.87 N.— "	23		18	7	5 1911.7	25 30 4	25 29 4 "

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
20.32 E.—N.E. cor. sec. 24	18	7	5	1911.7	25 23.7	25 23.7	E. S. Martindale.
28.91 W.— " 36	18	7	5	1911.8	25 31.9	25 30.9	"
10.00 W.— " 19	19	7	5	1911.7	25 26.5	25 26.5	A. L. Cumming.
8.00 S.— " 15	19	7	5	1911.7	25 30.1	25 26.4	"
5.00 W.—S.E. cor. sec. 1	19	7	5	1911.8	25 30.4	25 26.4	"
5.00 W.— " 2	19	7	5	1911.8	25 27.8	25 23.8	"
20.00 N.—N.E. cor. sec. 29	19	7	5	1911.8	25 29.9	25 28.9	"
10.00 S.— " 31	19	7	5	1911.9	25 28.8	25 24.3	"
At N.E. cor. sec. 36	20	7	5	1910.4	23 47.2	23 57.1	J. R. Akins.
9.00 W.—N.E. cor. sec. 31	20	7	5	1910.4	24 23.6	24 25.7	"
8.00 N.— " 24	21	7	5	1911.4	25 32.5	25 33.9	C. M. Walker.
At N.E. cor. sec. 12	22	7	5	1911.6	25 27.1	.....	"
41.00 N—N.E. cor. sec. 12	22	7	5	1911.6	25 29.7	25 27.2	"
20.00 S.— " 24	23	7	5	1911.8	25 17.4	25 15.4	"
60.00 E.— " 22	31	7	5	1910.9	25 39.2	25 43.6	G. J. Lonergan.
19.76 S.— " 34	47	7	5	1910.5	26 15.1	.....	L. E. Fontaine.
12.31 N.— " 21	49	7	5	1909.4	26 36.9	26 38.6	"
29.01 S.— " 2	51	7	5	1909.5	27 23.5	27 32.1	"
61.85 S.— " 6	52	7	5	1909.5	27 49.2	27 56.8	"
74.50 W.— " 33	55	7	5	1910.2	28 10.4	28 15.5	"
46.00 W.— " 32	61	7	5	1908.9	27 28.0	.....	G. J. Lonergan.
39.80 W.— " 31	80	7	5	1910.5	29 02.7	29 08.1	A. H. Hawkins.
66.95 E.— " 32	80	7	5	1910.5	29 00.3	29 01.7	"
9.16 E.— " 34	80	7	5	1910.5	29 20.7	29 26.1	"
42.00 W.— " 31	84	7	5	1911.4	31 08.2	.....	"
26.00 W.— " 36	84	7	5	1911.4	30 56.9	30 57.3	"
59.00 W.— " 34	84	7	5	1911.4	31 13.7	31 18.1	"
39.60 W.— " 32	84	7	5	1911.4	31 06.3	.....	"
10.00 S.— " 23	20	8	5	1911.8	25 38.2	25 33.0	A. L. Cumming
20.00 S.— " 14	20	8	5	1911.8	25 35.2	25 30.0	"
29.19 W.— " 35	20	8	5	1910.5	25 30.7	25 28.5	J. R. Akins.
72.64 W.— " 32	32	8	5	1909.8	26 30.9	26 32.6	B. J. Saunders.
72.64 W.— " 32	32	8	5	1909.8	26 31.9	26 33.6	"
63.84 W.— " 35	32	8	5	1909.8	26 16.7	.....	"
63.84 W.— " 35	32	8	5	1909.8	26 16.1	.....	"
8.00 W.— " 36	36	8	5	1909.5	26 29.1	26 31.5	"
8.00 W.— " 36	36	8	5	1909.5	26 29.6	26 31.0	"
42.00 W.— " 35	36	8	5	1909.5	26 29.0	26 31.4	"
63.44 N.— " 21	37	8	5	1910.6	26 19.8	26 22.9	L. E. Fontaine.
21.94 N.— " 29	38	8	5	1910.6	26 46.2	26 45.3	"
4.45 N.— " 16	48	8	5	1911.9	27 03.9	27 00.5	"
53.15 N.—N.E. cor. sec. 9	50	8	5	1911.2	27 28.3	27 32.4	"
2.10 N.— " 3	51	8	5	1911.2	27 35.7	27 36.8	"
50.89 S.— " 1	53	8	5	1909.6	27 41.4	27 47.3	"
46.14 W.— " 35	54	8	5	1910.3	28 07.0	28 14.2	"
0.61 S.—S.E. cor. sec. 5	59	8	5	1910.7	28 51.0	28 51.0	"
14.91 N.—N.E. cor. sec. 33	59	8	5	1910.7	29 10.7	29 14.7	"
39.00 W.— " 36	84	8	5	1911.5	31 12.3	31 12.4	A. H. Hawkins.
77.76 W.— " 31	84	8	5	1911.5	29 37.4	29 35.5	"
At N.E. cor. sec. 36	108	8	5	1910.3	32 53.7	33 02.4	A. W. Ponton.
" " 36	108	8	5	1910.3	32.51.1	32 55.3	"
" " 36	108	8	5	1910.3	32 53.0	.....	"
18.60 W.—N.E. cor. sec. 36	108	8	5	1910.3	33 07.7	33 06.9	"
18.60 W.— " 36	108	8	5	1910.3	33 07.3	33 10.5	"
At N.E. cor. sec. 36	108	8	5	1910.3	33 12.7	33 10.9	"
" " 36	108	8	5	1910.3	33 02.8	33 13.0	"
" " 36	108	8	5	1910.3	32 58.1	33 03.3	"
" " 36	108	8	5	1910.3	33 05.2	33 08.4	"
18.60 W.—N.E. cor. sec. 36	108	8	5	1910.3	33 07.7	33 07.9	"
18.60 W.— " 36	108	8	5	1910.3	32 53.3	33 01.5	"
18.60 W.— " 36	108	8	5	1910.3	32 53.4	32 57.6	"
18.60 W.— " 36	108	8	5	1910.3	32 58.8	33 02.0	"
18.60 W.— " 36	108	8	5	1910.3	33 09.6	33 11.8	"
18.60 W.— " 36	108	8	5	1910.3	32 59.4	33 05.6	"
18.60 W.— " 36	108	8	5	1910.3	32 46.3	32 55.5	"
18.60 W.— " 36	108	8	5	1910.3	32 48.7	32 57.9	"
18.60 W.— " 36	108	8	5	1910.3	32 51.8	[illegible]	"

TABLE No. 1—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912-0	
					° ′	° ′	
18.60 W.—N.E. cor. sec. 36	108	8	5	1910.3	32 52.1	32 59.3	A. W. Ponton.
18.60 W.— " 36	108	8	5	1910.3	32 55.2	32 59.4	"
18.60 W.— " 36	108	8	5	1910.3	33 05.7	33 04.9	"
13.00 W.— " 35	20	9	5	1910.5	25 21.6	25 30.0	J. R. Akins.
16.00 W.— " 36	20	9	5	1910.5	25 32.8	25 30.2	"
54.00 N.— " 35	20	9	5	1910.5	25 17.7	25 25.1	"
At N.E. cor. sec. 3	21	9	5	1910.6	25 25.8	25 28.9	"
52.00 N.—N.E. cor. sec. 22	21	9	5	1910.6	25 20.7	25 25.8	"
6.00 N.— " 27	21	9	5	1910.6	25 05.4	25 08.5	"
8.00 N.— " 34	21	9	5	1910.6	25 07.4	25 12.5	"
58.00 W.— " 35	21	9	5	1910.6	25 13.7	25 18.8	"
6.00 N.— " 36	21	9	5	1910.7	25 14.9	25 17.8	"
68.00 N.— " 27	22	9	5	1910.8	25 01.7	25 08.8	"
60.25 N.— " 12	22	9	5	1910.7	25 10.4	25 15.4	"
39.00 N.— " 13	22	9	5	1910.7	25 13.6	25 13.6	"
80.00 N.— " 13	22	9	5	1910.7	25 08.2	25 13.2	"
25.00 S.— " 29	23	9	5	1909.6	24 39.3	24 39.4	Jas. Warren
At S.E. cor. sec. 30	23	9	5	1909.6	24 30.6	24 26.7	"
10.00 N.—S.W. cor. sec. 20	23	9	5	1909.6	24 32.1	24 39.7	"
20.00 N.—S.E. cor. sec. 20	23	9	5	1909.6	24 41.4	24 42.3	"
At N.E. cor. sec. 9	23	9	5	1909.6	24 44.4	24 41.5	"
30.00 S.—N.E. cor. sec. 21	23	9	5	1909.6	24 32.2	24 36.3	"
At N.E. cor. sec. 9	23	9	5	1909.6	24 33.7	24 37.8	"
5.00 E.—N.E. cor. sec. 19	23	9	5	1909.6	24 40.6	24 32.7	"
20.00 S.— " 22	23	9	5	1909.6	24 47.4	24 38.5	"
30.00 S.— " 15	23	9	5	1909.6	24 42.8	24 49.9	"
10.00 S.—N.W. cor. sec. 30	23	9	5	1909.6	24 31.0	24 35.1	"
40.00 S.—S.W. cor. sec. 32	23	9	5	1909.6	24 33.1	24 34.2	"
30.00 S.—N.W. cor. sec. 30	23	9	5	1909.6	24 31.2	24 39.3	"
40.00 E.—S.W. cor. sec. 30	23	9	5	1909.6	24 34.2	24 38.3	"
50.00 S.—N.E. cor. sec. 16	23	9	5	1909.6	24 35.4	24 36.5	"
At N.E. cor. sec. 16	23	9	5	1909.6	24 35.5	24 42.6	"
42.00 E.—N.E. cor. sec. 10	23	9	5	1909.6	24 47.0	24 59.1	"
50.00 S.— " 15	23	9	5	1909.6	24 47.4	24 52.5	"
20.00 W.— " 10	23	9	5	1909.6	24 38.3	24 50.4	"
70.00 S.— " 4	23	9	5	1909.7	24 43.2	24 53.0	"
10.00 S.— " 8	23	9	5	1909.7	24 46.6		"
5.00 N.— " 4	23	9	5	1909.7	24 40.5	24 40.3	"
30.00 S.— " 4	23	9	5	1909.7	24 55.5	25 01.3	"
25.00 S.— " 5	23	9	5	1909.7	24 52.2	24 58.2	"
38.00 S.— " 5	23	9	5	1909.7	24 58.0	24 58.0	"
60.00 S.— " 10	23	9	5	1909.7	24 56.2	24 55.2	"
4.00 S.— " 10	23	9	5	1909.7	24 54.6	24 51.6	"
10.00 S.— " 2	23	9	5	1909.7	24 46.5	24 52.5	"
68.00 S.— " 11	23	9	5	1909.7	24 48.4		"
55.25 W.— " 2	23	9	5	1910.8	25 07.8	25 08.9	J. R. Akins.
46.50 W.—S.E. cor. sec. 3	23	9	5	1910.8	25 16.8	25 12.9	
8.00 S.—N.E. cor. sec. 10	24	9	5	1910.9	24 54.1	24 53.3	
17.00 W.— " 8	24	9	5	1910.9	24 57.3		"
27.00 S.— " 15	29	9	5	1909.6	24 52.9	24 50.0	Jas. Warren
30.90 W.— " 36	32	9	5	1909.8	26 37.9	26 38.6	B. J. Saunders
30.90 W.— " 36	32	9	5	1909.8	26 38.9	26 39.6	
52.95 W.—N.E. cor. sec. 31	32	9	5	1909.8	26 35.7	26 38.4	B. J. Saunders.
52.95 W.— " 31	32	9	5	1909.8	26 57.8	27 00.5	"
19.90 W.— " 32	36	9	5	1909.6	26 40.4	26 41.5	"
19.90 W.— " 32	36	9	5	1909.6	26 43.9	26 44.0	"
37.30 W.— " 35	36	9	5	1909.6	26 36.8	26 35.9	"
37.30 W.— " 35	36	9	5	1909.6	26 35.0	26 34.1	"
17.91 N.— " 14	48	9	5	1912.0	27 23.1	27 19.8	L. E. Fontaine.
2.79 N.— " 11	49	9	5	1912.0	27 37.1	27 31.4	"
14.15 N.— " 35	49	9	5	1911.2	27 33.1	27 36.2	"
7.90 N.— " 36	49	9	5	1911.2	27 30.1	27 33.2	"
39.68 S.— " 31	52	9	5	1909.5	28 00.5	28 07.7	"
13.57 N.— " 21	59	9	5	1910.7	28 07.1	28 08.1	"
At " 33	80	9	5	1910.5	29 11.5	29 19.3	A. H. Hawkins.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912·0	
					° ′	° ′	
13.00 E.—N E. cot. sec. 34	80	9	5	1910.5	29 08.9	29 12.7	A. H. Hawkins.
0 85 E.— " 35	80	9	5	1910.5	29 24 7	29 29.1	"
20 13 W.— " 36	84	9	5	1911.5	29 38.9	29 39.0	"
73 95 W.— " 35	84	9	5	1911 5	30 04.8	30 06.9	"
2 66 W.— " 32	84	9	5	1911.5	29 40.6	29 40.7	"
28.00 W.— " 32	108	9	5	1910.3	31 49.4	31 54.6	A. W. Ponton.
28 00 W.— " 32	108	9	5	1910.3	31 43.0	31 46.2	"
28.00 W.— " 32	108	9	5	1910 3	32 00.9	32 02 1	"
28.00 W.— " 32	108	9	5	1910.3	31 47.7	31 54.9	"
28.00 W.— " 32	108	9	5	1910.3	31 52.4	31 57 6	"
45 43 W.— " 36	32	10	5	1909.8	26 37.5		B. J Saunders.
45.43 W.— " 36	32	10	5	1909.8	26 44.6		"
39.64 W.— " 32	32	10	5	1909.9	26 45.1	26 45.5	"
39.64 W.— " 32	32	10	5	1909.9	26 47.1	26 47.5	"
69.90 W.— " 32	36	10	5	1909 6	27 45.0	27 45.1	"
42 62 W.— " 34	36	10	5	1909.6	27 29 3	27 30.4	"
9.88 S.— " 28	49	10	5	1911.7	27 58.0	27 53 0	L. E. Fontaine.
5 97 S.— " 9	52	10	5	1910.3	27 40.8		"
56.70 E.— " 31	80	10	5	1910.5	32 41.8		A. H. Hawkins.
43.11 E.— " 33	80	10	5	1910.5	30 22.1	30 25.9	"
43.20 W.— " 36	84	10	5	1911.5	29 30 9	29 30.1	"
8 53 W.— " 35	84	10	5	1911.5	30 19 8	30 23.0	"
66.92 W.— " 31	84	10	5	1911.5	30 27.6	30 33.8	"
69.02 W.— " 32	36	11	5	1909.7	26 43.5	26 33 5	B. J. Saunders.
69.02 W.— " 32	36	11	5	1909.7	26 45.7	26 35 7	"
58 10 W.— " 36	36	11	5	1909.7	27 09.0	27 06.8	"
58.10 W.— " 36	36	11	5	1909.7	27 09.2	27 08.0	"
64.07 S.— " 12	48	11	5	1912.0	28 19.2	28 15.5	L. E. Fontaine.
16.38 S.— " 35	49	11	5	1911.7	27 43.5	27 40.5	"
0.38 N.— " 32	57	11	5	1909.9	29 23.8	29 26 8	"
5.00 E.— " 31	80	11	5	1910.4	29 40.0	29 44.1	A. H. Hawkins.
76.00 E.— " 31	80	11	5	1910.5	29 46.6	29 49.4	"
7 00 E.— " 33	80	11	5	1910 5	30 01.2	30 05.0	"
25.00 E.— " 34	80	11	5	1910.5	30 02.8	30 05.6	"
25.00 W.— " 34	84	11	5	1911.5	29 44.6	29 48.8	"
11.43 W.— " 33	84	11	5	1911.5	29 33.8	29 38.0	"
61.52 W.— " 33	84	11	5	1911.5	29 26.0	29 28.2	"
27.24 W.— " 32	108	11	5	1910.6	33 16 4	33 15.5	A. W. Ponton.
27.24 W.— " 32	108	11	5	1910.6	33 13.7	33 20.8	"
27.24 W.— " 32	108	11	5	1910.6	33 17.6	33 21 7	"
27.24 W.— " 32	108	11	5	1910.6	33 14.3	33 16 4	"
27 24 W.— " 32	108	11	5	1910.6	33 29 1	33 26.2	"
27.24 W.— " 32	108	11	5	1910.6	33 27.7	33 27.8	"
27.24 W.— " 32	108	11	5	1910 6	33 20.1	33 26.2	"
27.24 W.— " 32	108	11	5	1910.6	33 11.8	33 14 9	"
3.30 S.— " 24	51	12	5	1911.7	28 00.6	27 56.6	L. E. Fontaine.
41.97 N.— " 22	52	12	5	1910 3	28 12.2		"
0 44 N.— " 24	54	12	5	1910.4	28 03.4	28 06 3	"
50.46 N.— " 23	56	12	5	1909 9	23 00.2	28 06.8	"
0.64 N.— " 32	57	12	5	1909.9	29 10.0	29 15.0	"
68.10 W.— " 31	80	12	5	1910 4	30 22.0	30 24.1	A. H. Hawkins.
4.61 E.— " 32	80	12	5	1910.4	30 20.8	30 24 9	"
5.00 E.— " 34	80	12	5	1910.4	29 51.3	29 53.4	"
6.00 E.— " 35	80	12	5	1910.4	29 48.7	29 51.8	"
20.25 W.— " 36	84	12	5	1911.5	28 57 0	29 02.2	"
64 53 W.— " 35	84	12	5	1911 5	29 25.9	29 27.1	"
30 00 W.— " 31	84	12	5	1911.6	29 17.9	29 16.8	"
44.73 W.— " 31	84	12	5	1911.6	29 16.0	29 15.9	"
54.34 W.— " 32	40	13	5	1908.7	27 35.8	27 45.3	B. J. Saunders.
8.46 N.— " 36	49	13	5	1911.9	27 48.1	27 41.6	L. E. Fontaine.
2.50 N.— " 16	50	13	5	1911.9	27 52.1	27 49.6	"
16.89 N.— " 9	51	13	5	1911.9	28 07.9	28 03.4	"
36.27 W.— " 20	56	13	5	1909.8	28 53 9	28 57 2	"
0.48 N.— " 10	57	13	5	1909 8	28 44.8	28 48.1	"
10.03 N.— " 10	59	13	5	1910.8	28 12.2	28 15.3	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date	Declination. Obs'd.	Declination. Reduced to 1912·0	Observer.
					° ′	°	
1.98 S.E.—N.E. cor. sec. 4.....	59	13	5	1911 4	28 19 1	28 21.5	L. E. Fontaine.
75.00 W.—N. E. cor. sec. 31.....	80	13	5	1910.4	30 01.0	.....	A. H. Hawkins.
At " 31.....	80	13	5	1910.4	30 04.0	30 08·9	"
60.00 E.— " 31....	80	13	5	1910.4	30 07 4	30 12.3	"
78.00 E.— " 32.....	80	13	5	1910 4	30 19.3	30 23.4	"
At " 34.....	80	13	5	1910 4	30 09 0	30 15.1	"
42.00 E.— " 35	80	13	5	1910.4	30 09.0	30 13.1	"
21.54 W.— " 35.	84	13	5	1911 6	29 19.2	29 23 1	"
21.54 W.— " 35	84	13	5	1911 6	29 21.1	29 25.0	"
78 64 W.— " 31.	84	13	5	1911 6	29 31.7	29 33.8	"
E. end Base (Castle Mt.) Approx. Middle N. ½ sec. 31....	27	14	5	1911.6	25 53 1	25 52.0	M. P. Bridgland.
24.36 W.—N. E. cor. sec. 34.....	40	14	5	1908.7	27 27.8	27 38.3	B. J. Saunders.
28.01 S.— " 12.....	54	14	5	1911.3	27 54.2	27 56 6	L. E. Fontaine.
10 76 S.— " 34.....	55	14	5	1909 8	28 57.1	28 59.8	"
66 33 W.— " 31.....	55	14	5	1909.8	29 15.3	29 14.0	"
16 00 W.— " 31	80	14	5	1910.4	29 37.8	29 41.7	A. H. Hawkins.
23.00 E.— " 31	80	14	5	1910.4	29 36.0	.....	"
20.00 E.— " 32	80	14	5	1910.4	29 43.2	.....	"
45.00 E.— " 33	80	14	5	1910.4	29 48.8	29 53.7	"
5.00 E.— " 35	80	14	5	1910.4	30 03.4	30 10 3	"
10 48 W.— " 32.....	84	14	5	1911.6	30 22.7	30 20.2	"
39.05 W.— " 36	84	14	5	1911 6	30 54.6	30 55.1	"
27.10 W.— " 31.....	84	14	5	1911.6	30 34.4	30 36 9	"
32.00 W.— " 32	40	15	5	1908 8	27 14 6	27 23 4	B. J. Saunders.
32.00 W. " 32.....	40	15	5	1908 8	27 14.4	27 21 2	"
32.75 N.— " 15	56	15	5	1911 4	29 23.0	.....	L. E. Fontaine.
At " 33.....	80	15	5	1910 1	29 24.8	29 26 7	A. H. Hawkins.
50 00 E.— " 34	80	15	5	1910 4	29 27 6	29 33 5	"
60.00 E.— " 35	80	15	5	1910 4	21 29.9	29 33.8	"
4 00 W.— " 36	84	15	5	1911 6	30 38.1	30 38 6	"
52 50 W.— " 34	84	15	5	1911 6	30 36 4	30 33 9	"
1.00 W.— " 31	84	15	5	1911 6	30 29.2	30 30.7	"
52.50 W.— " 34.	84	15	5	1911 6	30 40.6	30 41 1	"
2.00 W.— " 34.....	39	16	5	1910 4	26 43.0	26 47 1	J. B. McFarlane.
19.60 W.— " 32.....	39	16	5	1910 4	26 38 1	26 40 2	"
69 80 S.— " 28	39	16	5	1910.5	26 40 1	26 43 9	"
10.00 W.— " 7	39	16	5	1910.5	26 26 3	26 34.1	"
78.00 W.— " 19	39	16	5	1910 5	26 31.1	26 35 9	"
69.02 S.— " 25.....	40	16	5	1910.4	26 43.0	26 47 9	"
0.25 S.— " 3	56	16	5	1911 4	28 21.8	28 22 2	L. E. Fontaine.
10.62 N.— " 1.....	57	16	5	1911 8	28 46.9	28 40 9	"
At " 19	57	16	5	1911 8	28 26.0	28 21 0	"
66 24 W.— " 31.....	80	16	5	1910.3	29 27 6	29 33 8	A. H. Hawkins.
21.62 E.— " 32.....	80	16	5	1910.4	29 24.7	29 30 6	"
22.09 E.— " 35	80	16	5	1910.4	29 20.1	29 34 0	"
30.00 W.— " 34.....	84	16	5	1911.6	30 21 9	30 18 4	"
50.57 W.— " 31.....	84	16	5	1911.7	30 22.8	30 20 0	"
43.00 W.— " 36.....	84	16	5	1911.6	30 16 5	30 16 0	"
18 85 W.— " 33.....	84	16	5	1911 6	30 13.7	.....	"
18.00 N.— " 12.....	39	17	5	1910 5	26 40.7	26 45.1	J. B. McFarlane.
21.00 W.— " 23	39	17	5	1910 5	26 41.1	26 46 5	"
At " 22.....	39	17	5	1910.5	26 41.3	26 48.7	"
60 00 W.— " 32	39	17	5	1910.5	26 39 6	26 47 0	"
11.50 S.— " 26	39	17	5	1910.5	26 37 2	26 44.6	"
56 22 S.— " 23.....	39	17	5	1910.5	26 41 0	26 45.4	"
45.00 W.— " 22.....	39	17	5	1910.6	26 40.1	26 45.2	"
73.00 S.— " 28.....	39	17	5	1910.6	26 27.8	26 32 9	"
3.00 W.— " 36.....	39	17	5	1909.7	26 39.9	26 42.4	A. McFee.
At N. E. cor. sec. 36.....	40	17	5	1909.7	26 25 6	26 31 6	"
0.08 N.—N. E. cor. sec. 10.....	54	17	5	1910 8	29 12.3	29 14.4	L. E. Fontaine.
32 91 N.—N. E. cor. sec. 2.....	56	17	5	1911.4	27 39.6	27 42.4	"
25.00 N.—S. E. " 9	79	17	5	1911.8	29 29.3	29 26.3	G. J. Lonergan.
At S. E. " " 8.....	79	17	5	1911.8	29 29.7	29 23.7	"
43 07 E.—N.E. cor. sec. 31.....	80	17	5	1910.3	29 27.5	29 32.7	A. H. Hawkins.

TABLE No. 4—*Continued*..

Place.	Tp.	Rge	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0.	Observer.
					° ′	° ′	
5.57 E.—N.E. cor. sec. 34	80	17	5	1910 3	29 32.5	29 38.7	A. H. Hawkins.
10 00 W.— " 33	84	17	5	1911.7	29 54.7	29 52 9	"
38 00 W.— " 35	84	17	5	1911.7	30 06 4	30 02.4	"
At " 31	23	18	5	1911.7	26 04.3	26 01.5	C. H. Taggart.
2.00 N.— " 22	23	18	5	1911.7	25 52.5	25 49.5	"
5 00 S.— " 24	39	18	5	1909 7	26 42 1		A. McFee.
26.54 S.— " 31	51	18	5	1911.3	27 53.4		L. E. Fontaine.
17 01 N.— " 13	54	18	5	1910.8	28 40.8	28 39.5	"
1 10 S.— " 21	55	18	5	1911 4	27 58.8	27 58.6	"
32.30 S.— " 7	56	18	5	1911 8	28 23 7	28 19.7	"
41 45 E.— " 31	80	18	5	1910.3	29 28.8	29 37.0	A. H. Hawkins.
65.34 E.— " 34	80	18	5	1910.3	29 28.9	29 34.1	"
80.50 W.— " 36	84	18	5	1911.7	30 18.6	30 15.6	"
At " 35	84	18	5	1911.7	30 07.7	30 04.7	"
42.05 W... " 31	84	18	5	1911.7	30 39 6	30 35.6	"
8 00 W.—N. E. cor. sec. 16	24	19	5	1909 8	25 54.3	15 52.0	T. H. Plunkett.
30.00 N.— " " 30	24	19	5	1909.8	25 49.4	25 50.1	"
At " " 11	24	19	5	1911 6	25 45.1	25 42.6	C. H. Taggart.
33.00 E.—N. W. " 18	24	19	5	1911.7	25 53.3	25 39.3	"
At N. E. " " 32	40	19	5	1910.4	26 53.0	26 54.9	J. B. McFarlane.
32 00 S.—N. E. " 26	41	19	5	1909.5	26 27.8		A. McFee.
8 00 S.— " " 1	41	19	5	1909.4	26 23.0	26 29.9	"
4.00 N.— " " 27	41	19	5	1909 5	26 30.5	26 43.7	"
At " " 10	42	19	5	1909.5	26 23.8	26 34.0	"
10.00 S.— " " 1	42	19	5	1909 5	26 24.1	26 33 3	"
70.00 W.— " " 23	46	19	5	1911 6	27 36.4	27 34.3	A. L. McNaughton
70.00 S.— " " 16	46	19	5	1911 6	27 42.5	27 33.0	"
62.00 S.— " " 2	47	19	5	1910.7	27 53.9	27 56.7	"
50.00 S.— " " 4	47	19	5	1910.7	28 08.8	28 10.8	"
15.00 S.— " " 3	47	19	5	1910.7	27 59.6	27 59.6	"
45 00 S.— " " 11	47	19	5	1910.6	28 02.5	27 57.6	"
15.61 N.— " " 23	55	19	5	1911.4	28 25.6	28 24.4	L. E. Fontaine.
1.21 N.— " " 8	56	19	5	1911.8	28 39.5	28 33.5	"
10. 00 N.— " " 24	80	19	5	1911.8	29 03.2		G. J. Lonergan.
At " " 36	24	20	5	1909.8	25 53.1	25 56.8	T. H. Plunkett.
At " " 18	25	20	5	1910.9	25 51.1	25 49.3	D. A. Smith.
24 00 W. " " 10	25	20	5	1911.7	25 55.1	25 53.1	C. H. Taggart.
15 00 E. " " 31	43	20	5	1910.7	27 23.2	27 23.7	O. Rolfson
30.00 S.— " " 28	43	20	5	1910.8	27 11.8	27 11.8	"
36 00 S.— " " 16	43	20	5	1910.8	27 06.5	27 11.6	"
11 50 S.— " " 29	43	20	5	1910.8	27 14.6	27 15.7	"
22.00 S.— " " 20	43	20	5	1910.8	27 12.8		"
45 00 S.— " " 34	43	20	5	1911.8	27 20.5	27 17.5	J. Francis.
53 00 S.— " " 22	43	20	5	1911 8	27 12.7	27 08.7	"
11.00 W. " " 11	43	20	5	1911.8	27 04.2	27 03.2	"
28.00 N.— " " 11	43	20	5	1911.8	27 02.8	26 58.8	"
18 00 N.— " " 18	43	20	5	1911 8	27 12.0	27 10.0	"
15.00 W.— " " 33	44	20	5	1910.4	27 35.4	27 37.5	O. Rolfson.
8.00 N.— " " 21	44	20	5	1910.5	27 26.4	37 30.2	"
12.00 N.— " " 26	44	20	5	1910.5	27 23.4	27 36.8	"
7.00 S.— " " 27	44	20	5	1910.5	27 23.4	27 26.8	"
49.00 N.— " " 8	44	20	5	1911.7	27 29.4	27 27.4	J. Francis
60.00 S.— " " 19	44	20	5	1911.8	27 32.3	27 29 3	"
15.00 N.— " " 7	44	20	5	1911 8	27 28 5	27 25.5	"
2.00 S.— " " 7	45	20	5	1910.6	27 55.7	27 54.8	"
5.00 S.— " " 13	45	20	5	1911.7	27 51.9	27 42.1	A. L. McNaughton
10.00 S.— " " 12	46	20	5	1911.7	28 03 5	27 53.5	"
60 00 S.— " " 27	47	20	5	1911 8	27 58.3	27 50.3	"
At N. E. cor. sec. 12	48	20	5	1910.5	28 11.9		"
50.00 S.—N. E. cor. sec. 8	48	20	5	1911.8	28 12 4	28 08.4	"
12.91 S.— " " 24	51	20	5	1911.3	28 07.3	28 08.7	L. E. Fontaine.
3.84 N.— " " 22	55	20	5	1911.4	28 22.6		"
41.00 N.— " " 29	76	20	5	1911.8	30 02.7	29 59.5	G. J. Lonergan.
35.75 W.— " " 31	84	20	5	1911.7	30 34.5	30 31.5	A. H. Hawkins.
At " " 24	25	21	5	1910 9	26 05.6	26 06 8	D. A. Smith.
20.00 S.—¼ N. by sec. 34	25	21	5	1910.8	25 52.4	25 51.5	W. J. Deans.
At N. E. cor. sec. 35	25	21	5	1910 8	25 58.8	25 58.9	"

TABLE No. 4.—*Continued.*

Place.	Tp	Rge.	M r.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
20.00 W.—N. E. cor. sec. 32	25	21	5	1910.9	25 52.9	25 53.7	W. J. Deans.
71.50 S.— " " 36	25	21	5	1910.9	26 00.6	26 02.4	"
40.00 W.— " " 25	25	21	5	1910.9	25 59.0	26 00.8	"
30.00 N " " 26	25	21	5	1910.9	26 00.2	25 59.0	"
7.00 S.— " " 4	26	21	5	1910.8	26 00.1		"
At Centre " 10	26	21	5	1910.8	25 57.8	26 00.9	"
15.00 E. N. E. " 4	26	21	5	1910.8	25 52.2	25 56.3	"
8.00 S. " " 3	26	21	5	1910.8	25 50.4	25 52.0	"
10.00 S.— " " 9	26	21	5	1910.8	25 59.2	26 00.3	"
40.00 E. " " 8	26	21	5	1910.9	25 50.0		"
40.00 S.— " " 6	26	21	5	1910.9	25 46.2	25 47.0	"
At centre sec. 5	26	21	5	1910.9	25 54.6	25 55.4	"
22.00 W.—¼ post on E. by sec. 6.	27	21	5	1911.0	26 25.4	26 22.3	P. B. Street.
21.40 S.— " N. " 7.	27	21	5	1911.0	26 15.7	26 18.6	"
60.00 W.—N. E. cor. sec. 36	43	21	5	1910.7	27 24.3	27 22.3	O. Rolfson.
58.00 S.— " " 1	44	21	5	1910.7	27 28.3	27 27.8	"
45.85 W.— " " 36	44	21	5	1910.6	27 46.4	27 51.5	J. B. McFarlane.
29.63 W.— " " 35	44	21	5	1910.6	27 51.0	27 52.1	"
1.43 W.— " " 33	44	21	5	1910.6	27 46.6	27 51.2	"
56.40 W.— " " 32	44	21	5	1910.6	27 47.7	27 50.8	"
41.00 S.— " " 14	45	21	5	1910.6	27 57.0		J. Francis.
2.00 N.— " " 12	48	21	5	1911.9	28 16.7	28 12.2	A. L. McNaughton
10.00 S.— " " 22	48	21	5	1911.9	28 17.0	28 12.5	"
52.00 S.— " " 31	48	21	5	1910.7	27 56.4	27 58.4	"
At " " 19	48	21	5	1910.7	27 54.9	27 54.9	"
70.00 S.— " " 32	43	21	5	1910.8	27 51.0	27 57.7	"
50.00 S.— " " 33	48	21	5	1910.8	27 59.9	28 02.1	"
53.60 S.— " " 34	52	21	5	1909.7	27 40.0	27 45.8	L. E. Fontaine.
20.00 W.-N.E. cor. sec. 20	76	21	5	1911.8	30 00.2	29 58.2	G. J. Lonergan
At " " 11	27	22	5	1908.4	25 05.8	25 15.4	T. H. Plunkett
12.00 W. ¼ cor. E. by sec. 25	27	22	5	1910.9	26 11.2	26 08.1	P. B. Street
12.00 W.— " 25	27	22	5	1910.9	26 06.8	26 09.7	"
63.35 W.-N.E. cor. sec. 36	44	22	5	1910.6	27 42.7	27 48.3	J. B. McFarlane
43.82 W.- " " 32	44	22	5	1910.7	27 42.8	27 46.6	"
38.72 N.- " " 31	45	22	5	1910.8	27 45.8	27 48.9	"
39.78 N.- " " 32	45	22	5	1910.8	27 45.9		"
1.65 S.- " " 12	45	22	5	1910.6	27 46.1	27 50.2	"
65.10 N.- " " 12	45	22	5	1910.6	27 48.6	27 52.2	"
27.53 N.- " " 2	45	22	5	1910.6	27 41.7	27 44.3	"
48.57 W.- " " 11	45	22	5	1910.6	27 39.0	27 42.1	"
73.45 N.- " " 3	45	22	5	1910.6	27 41.0	27 43.6	"
28.40 W.- " " 10	45	22	5	1910.6	27 45.8	27 48.9	"
49.49 N.- " " 15	45	22	5	1910.7	27 45.7	27 47.5	"
26.32 N.- " " 24	45	22	5	1910.7	27 51.5	27 53.5	"
15.40 N.- " " 23	45	22	5	1910.7	27 51.9	27 53.9	"
34.17 W.- " " 34	45	22	5	1910.7	27 47.2	27 52.2	"
37.96 N.- " " 22	45	22	5	1910.7	27 50.2	27 50.7	"
29.46 W.- " " 34	45	22	5	1910.7	27 50.1	27 52.1	"
28.41 W.- " " 31	45	22	5	1910.7	27 53.9	27 56.9	"
37.15 W.- " " 33	45	22	5	1910.7	27 48.2	27 50.2	"
59.94 W.- " " 32	45	22	5	1910.7	27 46.2		"
5.50 W " " 20	45	22	5	1910.7	27 55.6	27 51.0	"
15.73 N.- " " 30	45	22	5	1910.8	27 51.4	27 54.5	"
66.25 N " " 6	46	22	5	1910.8	27 41.2	27 42.3	"
38.23 W.- " " 7	46	22	5	1910.8	27 47.2		"
5.00 N.- " " 1	49	22	5	1910.7	27 58.9		A. L. McNaughton
30.00 N.- " " 3	49	22	5	1910.8	27 58.8		"
At " " 4	49	22	5	1910.8	27 47.8	27 48.9	
27.00 N.- " " 35	48	22	5	1910.8	27 50.4	27 49.5	
3.83 S.- " " 22	51	22	5	1911.3	27 24.6		L. E. Fontaine
17.25 N.- " " 32	52	22	5	1910.9	27 06.3	27 07.7	"
24.36 N.- " " 11	52	22	5	1909.7	27 21.0	27 27.0	"
12.18 N.- " " 13	54	22	5	1911.4	28 44.2	28 46.0	"
45.00 E.- " " 22	76	22	5	1911.8	29 57.0	29 54.0	G. J. Lonergan
20.00 N.- " " 23	76	22	5	1911.8	29 55.6	29 51.6	"
At " " 32	44	23	5	1911.4	27 45.6	27 48.4	J. Francis
33.28 N.- " " 36	44	23	5	1910.7	27 50.4	27 51.2	J. B. McFarlane

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
59.45 N.–N.E. cor. sec. 1	45	23	5	1910.7	27 46.8	.....	J. B. McFarlane.
74.10 N. " " 12	45	23	5	1910.7	27 49.3	27 49.3	"
27.77 N.– " " 36	45	23	5	1910.7	28 01.3	28 01.3	"
20.00 N.– " " 29	45	23	5	1911.5	27 46.2	27 46.4	J. Francis
20.00 N.– " " 31	45	23	5	1911.5	27 48 8	27 53.0	"
56.00 S.– " " 31	45	23	5	1911.5	27 49.5	27 52.7	"
65.00 W.– " " 12	45	23	5	1911.4	27 45.2	27 47.0	"
19.00 S.– " " 14	45	23	5	1911.4	27 45.2	.....	"
42.00 S.– " " 22	45	23	5	1911.4	27 45.1	27 46.9	"
15.00 N.– " " 10	45	23	5	1911 4	27 49.2	27 50.0	"
25.60 S.– " " 15	45	23	5	1911.4	27 45.2	27 45.0	"
7.50 S.– " " 21	45	23	5	1911.4	27 36.5	27 43.3	"
5.00 N.– " " 9	45	23	5	1911.4	27 36.0	27 39.8	"
7.00 N.– " " 16	45	23	5	1911.4	27 48.1	27 52.5	"
30.00 N.– " " 4	45	23	5	1911.4	27 43.0	27 45.4	"
55.50 W.– " " 36	45	23	5	1911.4	27 41.9	27 43.3	"
22.00 N.– " " 35	45	23	5	1911.4	27 40.7	27 43.1	"
55.00 S.– " " 34	45	23	5	1911.4	27 30.0	.....	"
At " " 33	45	23	5	1911 4	27 40.6	27 44.0	"
6.00 S.– " " 33	45	23	5	1911 5	27 45.0	27 49.1	"
4 00 S.– " " 28	45	23	5	1911 5	27 38.3	27 42.4	"
30 00 W.– " " 31	45	23	5	1911 5	27 43 5	27 47.6	"
46.00 W.– " " 32	45	23	5	1911 5	27 53.3	.....	"
24.00 N.– " " 2	46	23	5	1911 5	27 46.8	27 48 9	"
22.00 N.– " " 3	46	23	5	1911 5	27 44.4	27 48.6	"
35.00 S.– " " 19	46	23	5	1911.6	27 53 6	27 54.1	"
53.17 N.– " " 1	46	23	5	1910.8	27 57.4	.....	J. B. McFarlane.
36.00 N.– " " 5	49	23	5	1910.5	27 56 2	28 01.6	J. Francis.
44.00 W.– " " 8	49	23	5	1910.6	28 01.4	28 04.5	"
5.71 N.– " " 24	53	23	5	1909.7	28 45.4	28 49.4	L. E. Fontaine.
30.00 N.–S.E " 10	83	23	5	1911.6	31 43.8	31 42.7	G. J. Lonergan.
At N.E " 12	85	23	5	1911.6	31 37.5	31 37.4	"
15 00 S.–N.E. " 36	45	24	5	1911.5	27 52.2	27 55.4	J. Francis.
41.00 S.– " " 2	46	24	5	1911.6	27 58.7	27 57.6	"
8.00 S.– " " 3	46	24	5	1911.6	27 56.8	.....	"
28.00 S.– " " 13	46	24	5	1911.6	27 59.1	27 58.6	"
3 50 N.– " " 14	46	24	5	1911.6	27 49.8	27 50.3	"
At " " 23	46	24	5	1911.6	27 45 2	27 43.7	"
At " " 22	46	24	5	1911.6	28 03.7	28 02.2	"
28 00 W.– " " 21	46	24	5	1911.7	27 59.1	27 56.1	"
22.50 N.—N.E. cor. sec. 21	46	24	5	1911.7	27 55·9	27 51·9	J. Francis.
28.00 N.— " 20	46	24	5	1911.7	27 58·8	27 55·8	"
65.00 N.— " 19	46	24	5	1911.7	28 00·4	27 57·4	"
7.00 W.— " 19	48	24	5	1910.5	28 04·4	28 07·2	"
42.00 S.— " 20	48	24	5	1910.5	28 05·6	28 10·9	"
12.00 E. 32.50 S.–N.E. cor. sec. 7.	49	24	5	1910.5	28 12·1	28 12·5	"
64.03 S.—N.E. cor. sec. 3	52	24	5	1909.7	28 32·2	28 30·2	L. E. Fontaine.
5.00 N.—S.E. " 25	48	25	5	1910.4	27 50·5	27 55·4	J. Francis.
10.00 S.—N.E. " 23	48	25	5	1910.4	27 50 1	27 54·8	"
10 00 W. " " 24	48	25	5	1910 5	27 59·2	28 02 6	"
50 00 N.—S.E. " 1	49	25	5	1910.4	28 03·9	28 07·5	"
40.00 N.—N.E. " 1	49	25	5	1910 4	28 02·3	28 04·4	"
40 00 S. – " " 34	51	25	5	1910 8	28 26 8	28 32·9	A. L. Cumming.
17.00 N.— " " 7	51	25	5	1910.7	28 23 3	28 24·3	"
15.00 W.—S.E. " 5	51	25	5	1909 4	28 03 5	28 03·2	J. B. McFarlane.
47.62 W.—N.E. " 32	56	25	5	1909 4	28 54·7	29 02·4	A. H. Hawkins.
20.00 N.— " " 28	26	26	5	1911 6	26 02 7	25 59·6	M. P. Bridgland.
15.00 W.— " " 20	50	26	5	1909.4	27 46·3	27 50 0	J. B. McFarlane.
10.00 S. 39°48'. 5 E.—N.E. cor. 32	50	26	5	1909 4	27 56 6	28 00·3	"
At N.E. cor. sec. 32	50	26	5	1909.4	28 00 0	27 54·7	"
30.00 S.— " 29	50	26	5	1909.4	28 00·1	.....	"
50 00 S.— " 33	50	26	5	1909.4	27 48·4	27 49·6	"
8.00 E.— " 32	50	26	5	1909.3	27 55·9	27 57·9	"
10.00 S.— " 24	51	26	5	1910.6	28 31·2	28 34·3	A. L. Cumming.
At " 35	51	26	5	1910.7	28 29·8	28 31·8	"
12.00 S.— " 28	51	26	5	1910.7	28 26 1	28 29·1	"
At N.E. cor. sec. 8	51	26	5	1910.7	28 26·4	28 26·4	"

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
7.00 N.—N.E. cor. sec. 18	51	26	5	1910.7	28 25·8	28 24·8	A. L. Cumming.
At " 19	51	26	5	1910 7	28 21 4	28 21·4	"
At " 12	51	26	5	1909 3	28 26·1	28 28·1	J. B. McFarlane.
7.00 S.— " 26	52	26	5	1910 4	28 26·6	28 31 7	A. L. Cumming.
11.00 E.— " 23	52	26	5	1910 4	28 27 8	28 34·9	"
51.00 S.— " 27	52	26	5	1910.5	28 25·7	28 28 5	"
11.00 E.— " 21	52	26	5	1910 5	28 20 9	28 25·7	"
4 00 W.— " 12	52	26	5	1910 5	28 22·7	28 26·1	"
10.00 N.— " 30	52	26	5	1910 6	28 21·3	28 23·4	"
At " 9	52	26	5	1910 6	28 24·6	28 27·7	"
29 44 W.— " 5	56	26	5	1909 4	28 58·2	28 55 9	A. H. Hawkins.
41.23 W. " 36	56	26	5	1909 4	28 59 0	28 59·7	"
40.00 W.— " 34	56	26	5	1909 4	28 55 7	28 56·4	"
38.00 S.— " 32	48	27	5	1911 4	27 33·2	27 37·6	G. H. Herriot.
37.02 S.— " 33	48	27	5	1911 5	27 32·4	27 35 5	"
2 00 N.— " 5	49	27	5	1911.4	27 55·2	27 47·6	"
10 00 N.— " 17	49	27	5	1909 5	27 50 0	27 55 2	J. B. McFarlane
At " 10	49	27	5	1909 5	27 50·8	26 48·4	"
45 00 W. " 10	49	27	5	1909 5	27 44·7	27 53·3	"
49.00 S.— " 23	50	27	5	1909 4	27 46 4	27 50·8	"
17 00 W.— " 11	50	27	5	1909 4	27 46·8	27 51·7	"
55.00 E.— " 11	50	27	5	1909 4	27 54 3	27 50·2	"
49.00 S.— " 23	50	27	5	1909 4	27 58 6	27 54·5	"
6.00 S.— " 2	50	27	5	1909 4	27 45·0	...	"
35.00 S.— " 11	50	27	5	1909 4	27 49 6	27 52 5	"
42.00 S.— " 11	50	27	5	1909.4	28 01·4	27 55 3	"
31.10 W.— " 35	56	27	5	1909.4	29 11·4	29 14·3	A. H. Hawkins.
46.62 W.— " 34	56	27	5	1909 4	28 59 7	29 00·6	"
At " 12	48	28	5	1909 5	26 51·0	26 55 4	J. B. McFarlane.
40.00 S.— " 13	48	28	5	1909 5	27 11·3	27 04 7	"
32.00 W.— " 11	48	28	5	1909 6	27 05·8	27 10·9	"
44 00 S. " 14	48	28	5	1909 6	27 20·3	27 12 4	"
14.00 E.— " 29	20	29	5	1910 7	25 39·7	25 39·7	G. H. Blanchet.
At S. W. cor. sec. 24	20	1	6	1908 9	24 49 3	24 55·4	T. H. Plunkett.
15.00 N.—¼ on E. By. sec. 26	21	1	6	1910 6	25 56·4	25 57 5	G. H. Blanchet.
At N. E. cor. sec. 33	21	1	6	1909 6	26 00 7	26 02·8	T. H. Plunkett.
At about centre sec. 20	22	1	6	1910.8	25 58 9	25 56·0	P. B. Street.
" 20	22	1	6	1910 8	25 47·7	25 50 8	"
40.00 S.—N. E. cor. sec. 5	24	1	6	1909 7	25 52·2	25 52 2	E. W. Robinson.
65 00 S. " 5	24	1	6	1909.7	25 44·9	25 51·9	"
50.00 S.— " 21	45	1	6	1909.7	26 56·1	26 59·1	J. B. McFarlane.
4.00 N.— " 17	45	1	6	1909 7	26 57·9	27 00·9	"
60.00 W.— " 5	45	1	6	1909 7	26 52 9	27 02 9	"
20.00 W.— " 5	45	1	6	1909 7	27 00·1	27 00·1	"
75.00 S.— " 3	46	1	6	1909 7	27 00·1	27 04·1	"
17.00 S.— " 16	46	1	6	1909 7	26 58 6	27 08 4	"
15.00 N.— " 21	46	1	6	1909 7	27 10·3	27 11·1	"
72.00 S.— " 16	47	1	6	1909.6	26 55·6	26 58·7	"
36.00 W.—¼ sec. E. By. sec. 22	47	1	6	1909 6	27 00·9	27 09·0	"
20 00 W.— " 22	47	1	6	1909 6	27 11·8	27 14·9	"
At S. E. cor. sec. 5	47	1	6	1909 7	27 11·0	27 14·8	"
At N. E. " 16	47	1	6	1909 6	27 03·5	27 15·6	"
11 00 E.—N. E. cor. sec. 17	47	1	6	1909 6	27 14·0	27 11·1	"
Intersection of 15th Base Line and 6th Meridian	56	1	6	1909.4	28 45·8	28 52 5	A. H. Hawkins.
20.03 W.—N. E. cor. sec. 35	56	1	6	1909 5	28 41 1	28 53·7	"
45.16 W.— " 31	56	1	6	1909 4	28 51·1	28 58 6	"
34.79 W.— " 32	56	1	6	1909.4	28 33 5	28 46·0	"
36.92 W.— " 33	56	1	6	1909 5	28 50 5	28 55·1	"
5.00 W.— " 36	60	1	6	1909 8	28 50·3		"
24.40 W.— " 35	60	1	6	1909 8	28 46 3	28 47 0	"
29.44 W.— " 33	60	1	6	1909 8	28 39·4	28 47 1	"
32.00 W.— " 33	64	1	6	1909 7	29 05 1	29 10 9	G. McMillan.
60.00 N.—S. E. " 6	82	1	6	1911 6	30 51 4	30 28·9	G. J. Lonergan.
At N. E. " 13	22	2	6	1909 6	26 08·9	...	T. H. Plunkett.
10 chs. E.—N.E. " 16	23	2	6	1909 0	24 58·6	...	E. W. Robinson.
5 chs. N.— " " 20	23	2	6	1908.5	25 00·5	25 10·0	T. H. Plunkett.

TABLE No. 4.—*Continued.*

Place	Tp.	Rge.	Mer.	Date.	Declination. Obsd.	Declination. Reduced to 1912 0	Observer.
					° ′	′ ″	
At N.E. cor. sec. 13.....	23	2	6	1911.7	25 33 1	25 29 1	M. P. Bridgland.
10.00 N.— " " 26.....	23	2	6	1909 8	25 37·1	25 35 8	E. W. Robinson.
40 00 N.— " " 26.....	23	2	6	1909.8	25 32·4	25 37·1	"
50.00 W.— " " 7	23	2	6	1909 6	25 24·4	25 23·5	"
30 00 W.— " " 7..... ..	23	2	6	1909 6	25 17·9	25 29·0	"
34.00 W.— " " 11	23	2	6	1911 0	26 04 5	26 03·4	G. H. Blanchet.
20.00 N.—S. E. " 3	23	2	6	1909 7	26 04·1	26 10·1	T. H. Plunkett.
67.00 W.—N. E. cor. S. E. ¼ sec. 2..	23	2	6	1909 7	25 56·2	25 47·2	"
10.00 S.—N. E. cor. sec. 5..... ..	24	2	6	1909.7	25 46·7	25 19·7	E. W. Robinson.
40.00 S.— " 5	24	2	6	1909 7	25 40·5	25 50·5	"
15.00 W.— " 4	24	2	6	1909 7	25 46 2	.....	"
40.00 W.— " 4	24	2	6	1909.7	25 42·0	25 53·8	"
30.00 W.— " 27.	24	2	6	1909 5	25 43·2	25 42·6	"
40.00 W.— " 27	24	2	6	1909 5	25 40·1	25 48·5	"
9.50 W.—N. E. cor. L. S. 4 sec. 10.	24	2	6	1910 8	25 58·3	25 55 4	P. B. Street.
9.50 W.— " .	24	2	6	1910 8	25 58·6	26 06·7	"
40.00 E.—N. E. cor. sec. 9..... ...	25	2	6	1909 5	25 48·6	25 47·8	E. W. Robinson.
10 00 N.—Centre sec. 10	25	2	6	1909 5	25 39·2	25 52·4	"
40.00 E.—N. E. cor. sec. 20.....	25	2	6	1909 5	25 50·7	25 49·3	"
15.00 E.— " 20.....	25	2	6	1909 5	25 43·7	25 53·8	"
At " 16	26	2	6	1909 5	25 47·0	25 48·2	"
At " 16	25	2	6	1909 5	25 42 7	25 51·9	"
40.00 S.— " 32	26	2	6	1909.4	25 50·4	.....	"
40.00 S.— " 32.	26	2	6	1909 4	26 00·2	25 49·1	"
30.00 W.— " 6.... ..	27	2	6	1909 5	26 15·0	26 17·6	"
5.00 W.— " 6	27	2	6	1909 5	26 10·2	26 23·8	"
35.00 W.— " 1..... ..	45	2	6	1909.7	26 52·6	.....	J. B. McFarlane.
At " 1.....	45	2	6	1909 7	26 59·4	.....	"
72.00 W.— " 11.....	45	2	6	1909.7	26 56 2	27 04·2	"
25.00 W.— " 11.....	45	2	6	1909.7	27 00·5	27 00·5	"
19.00 E.— " 3.....	45	2	6	1909 7	26 57·4	27 05·4	"
16.00 N.— " 3.....	45	2	6	1909.7	26 54·3	26 56·8	"
6.00 E.— " 7.....	45	2	6	1909.8	27 09·3	27 07·0	"
55.00 W.— " 7.....	45	2	6	1909.8	27 01·1	27 05·8	"
59.89 W.— " 36.	56	2	6	1909 5	28 42·5	28 52·7	A. H. Hawkins.
31.49 W.— " 32.....	56	2	6	1909.6	28 51·3	.....	"
2.22 W.— " 33	56	2	6	1909.5	28 44·7	28 47·9	"
27.67 W.— " 35	56	2	6	1909.5	28 42·3	28 48·5	"
71.00 W.— " 35..... ...	60	2	6	1909.8	30 12 8	30 20 5	"
At " 32.	60	2	6	1909 8	29 05·0	29 06·7	"
64.00 W.— " 34.....	64	2	6	1909.7	29 04·8	29 10·8	G. McMillan.
5.00 N.— " 28.....	71	2	6	1911 6	27 45·2	27 43·7	G. J. Lonergan.
27.00 N.— " 15	45	3	6	1909.8	27 10·8	27 13·5	J. B. McFarlane.
15.00 S.— " 15.	45	3	6	1909.8	27 12 6	27 11·3	"
46.00 W.— " 20	45	3	6	1909.8	27 08·7	27 15·4	"
At " 17..	45	3	6	1909.8	27 20·9	27 15·6	"
56 20 W.— " 36	56	3	6	1909 6	28 38 9	28 36 8	A. H. Hawkins.
47.76 W.— " 33	56	3	6	1909.6	29 29·0	29 29·9	"
79.97 W.— " 35.....	56	3	6	1909.6	28 27·0	28 27·9	"
65.00 W.— " 35	60	3	6	1909 8	28 45·5	.....	"
At " 31	60	3	6	1 09 8	28 40·8	.....	"
50 00 W.— " 33.....	64	3	6	1909 7	29 08 0	29 12 0	G. McMillan.
40.06 W.— " 21.....	80	3	6	1908 5	29 52 9	30 02·4	J. B. Saint Cyr.
3.00 S.— " 24..... ...	45	4	6	1909 8	27 12·9	27 16·2	J. B. McFarlane.
25.00 N.— " 14	45	4	6	1909 8	27 14·2	27 20·5	"
3.00 N.— " 14.....	45	4	6	1909 8	27 19·4	27 14·7	"
43.66 W.— " 33.....	56	4	6	1909.6	28 35·0	28 37·1	A. H. Hawkins.
21 80 W.— " 34..... ..	56	4	6	1909 6	28 29 0	28 25·1	"
2.08 W.— " 36.....	56	4	6	1909 6	28 41·1	28 44·0	"
78.38 W.— " 34..... ..	60	4	6	1909 8	28 41 4	....	"
13.00 W.— " 31.....	64	4	6	1909.7	29 04·0	29 09 0	G. McMillan.
At " 10.....	79	4	6	1911.7	29 59·4	29 55·7	G. J. Lonergan.
60.00 E.— " 9.....	79	4	6	1911 8	30 09·0	30 05 0	"
41.00 W.— " 7.....	79	4	6	1909.7	30 28 6	30 30·6	J. B. Saint Cyr.
40.00 S.— " 21..... ..	80	4	6	1908.5	29 56·9	30 08·2	"
40.05 W.— " 7.....	80	4	6	1908.5	29 52·5	30 03·0	"
Sta. 33, traverse E. side Mabel Lake.	20	5	6	1910.8	26 21·6	26 20·7	T. H. Plunkett.

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obsd.	Reduced to 1912 0	
					° ′	° ′	
0.68 W.—N. E. cor. sec. 31	56	5	6	1909 6	28 37 3	28 36·4	A. H. Hawkins.
19.76 W.— " 32	56	5	6	1909.6	28 25 2	28 36 3	"
19.76 W.—N.E. cor. sec. 32	56	5	6	1909.6	28 17·3	28 25 4	A. H. Hawkins.
16.47 W.— " 33	60	5	6	1910 6	28 42·5	28 45·0	G. McMillan.
21.00 W. " 32	64	5	6	1909.8	28 58·6	29 00 3	"
At " 32	74	5	6	1911 7	29 24·3	29·22·3	G. J. Lonergan.
At " 4	77	5	6	1909.6	29 32 0	29 27·1	J. B. Saint Cyr.
At " 26	77	5	6	1909.5	29 48·6	29 51·0	"
At " 28	77	5	6	1909 5	29 50 9	29 54 3	"
At " 30	77	5	6	1909 5	30 01 6	30 03 0	"
20.00 N. S.E. " 16	77	5	6	1909.6	29 56 6	29 56·7	"
At N.E. " 7	77	5	6	1909.6	29 52·6	29 54·7	"
20 00 S.—N.E. " 21	78	5	6	1909 6	30 13 8	30 19 9	"
At " " 14	78	5	6	1909.7	29 56·6	30 00·4	"
At " " 5	78	5	6	1909 5	30 05·1	30 11·7	"
At " " 32	78	5	6	1909 7	30 25 0	30 30·0	"
At " " 19	78	5	6	1909 7	30 25 8		"
12.00 S.— " " 1	78	5	6	1908 7	29 47·3	29 53·8	"
At " " 5	79	5	6	1909 8	30 24·2	30 26 9	"
At " " 29	79	5	6	1909.8	30 15·3	30 16·0	"
At " " 16	79	5	6	1909 7	30 23·1	30 26·1	"
At " " 14	79	5	6	1909 7	30 13 6	30 17 6	"
10.00 N.—N.W. cor. sec. 8	79	5	6	1909 8	30 33 2	30 36·9	"
20.00 E.— " 36	79	5	6	1909.4	30 29·7		"
17.00 S.—N.E. cor. sec. 7	19	6	6	1911 8	21 19·3	21 15·3	M. P. Bridgland.
40.00 N. " 9	19	6	6	1909 8	25 38 6	25 38·3	E. W. Robinson.
25.00 N.— " 9	19	6	6	1909.8	25 35.1	25 39·8	"
60 W 00—¼ cor. E. By. sec. 7	22	6	6	1908 6	26 02·2		"
At ¼ cor. E. By. sec. 5	22	6	6	1908.6	26 05·7		"
10 00 N.—N.E. cor. sec. 23	23	6	6	1908 8	26 05·7	26 13·5	"
At " 7	23	6	6	1908 8	25 46·3	25 48·1	"
At S. E cor. sec. 6	23	6	6	1908.8	26 08·3	26 18 1	"
15.80 W.—N. E. cor. sec, 23	56	6	6	1909.6	28 08·3	28 18·4	A. H. Hawkins.
39 00 W. " 33	56	6	6	1909.6	28 19·8		"
10 13 W.— " 31	56	6	6	1909 6	28 10·0	28 08 1	"
50.00 W. " 34	56	6	6	1909.6	28 09·9	28 19·0	"
At " 34	56	6	6	1909.6	28 00·7	27 59 8	"
At " 35	56	6	6	1909 6	28 21·7	28 19·8	"
38.20 W. " 34	60	6	6	1910.6	28 22·6	28 24·1	G. McMillan.
70 00 W. " 33	61	6	6	1909 8	28 46 9	28 42 6	"
At " 26	77	6	6	1909.9	30 29·7	30 27 7	J. B. Saint Cyr.
At " 33	77	6	6	1909.9	31 19·2	31 22 2	"
At " 30	77	6	6	1909.8	31 14·4		"
At " 20	77	6	6	1909.8	31 05 3	31 02 6	"
40.00 E. " 21	78	6	6	1909.9	31 30 6	31·28·6	"
60.00 N. S.E. cor. sec. 2	78	6	6	1909.9	31 14 7		"
At N.E " 6	78	6	6	1909 9	31 25 3	31 24 3	"
61 00 S. " 1	78	6	6	1909.4	30 55 8	31 00·5	"
At S. W cor. sec. 6	79	6	6	1909 7	31 27·1	31 30·1	"
40.00 S.—N.E. cor. sec. 12	79	6	6	1909 4	30 29 3		"
5.00 E.— " 34	18	7	6	1909.8	25 37·4	25 36·1	E. W. Robinson.
30 00 E.— " 31	18	7	6	1909.8	25 32 0	25 37·7	"
20 00 E.— " 27	21	7	6	1908.7	24 43 7	24 54 2	"
2° 50 W.—¼ post E By. sec. 35	21	7	6	1908 7	26 20·5		"
15 00 S.—N.E. cor. sec. 17	24	7	6	1910.7	26 05 0	26 05 0	W. J. Deans.
40.00 W. " 5	24	7	6	1910.7	26 05·8	26 07 8	"
40 00 S. " 6	24	7	6	1910.7	26 08·1	26 08 1	"
50 00 E.— " 17	24	7	6	1910 7	26 21 1	26 26·1	"
40.00 S.— " 27	24	7	6	1910 8	26 12 5		"
30.00 S.—Centre sec. 35	24	7	6	1910.8	26 13 1	26 16·7	"
32.00 W.— " 8	24	7	6	1910.8	25 58·7	25 59·8	"
29 00 E.—¼ E. By. sec. 27	25	7	6	1910.7	25 29 6	25 21·1	D. A. Smith.
10.00 E.—Centre N. By. sec. 24	25	7	6	1910.7	25 36 8	25 39 3	"
40.00 S.— " 11	25	7	6	1910.8	25 36·4	25 36 5	"
3.00 E.—N.E. cor. sec. 7	26	7	6	1910 6	27 29·8	27 25 9	P. B. Street.
3 00 E.— " 7	26	7	6	1910.6	27 14·5	27 23·6	"
5.00 N.—Centre sec. 6	26	7	6	1910 7	26 48 7	26 47·2	"

TABLE No. 4.—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
47 40 W.—N.E. cor. sec 34	56	7	6	1909.6	27 58·9	28 09·0	A. H. Hawkins.
48 46 W.— " 34	56	7	6	1909.7	27 55·1	27 54·9	"
20 03 W.— " 32	56	7	6	1909.7	27 37·4	27 47·2	"
19 28 W.— " 31	56	7	6	1909.7	27 44·4	27 42·4	"
71 09 W.— " 34	60	7	6	1910.6	27 53·4	27 51·9	G. McMillan.
52.32 W.— " 31	64	7	6	1909.8	28 38·6	28 42·3	"
At " 36	21	8	6	1908.5	25 38·1	26 08·6	E. W. Robinson.
30.00 N.—Centre sec. 32	21	8	6	1910.6	26 00·2	25 59·3	G. H. Blanchet.
Traverse	23	8	6	1910.5	24 57·2	24 59·0	"
5.00 W.—Centre sec. 16	23	8	6	1910 5	25 03·0	25 05·8	"
20.00 S.—N.E cor. sec. 7	23	8	6	1910.5	27 28·9	27 31·3	"
6.25 W.—N.W. " 23	24	8	6	1910.6	26 24·9	26 31·0	W. J. Deans.
25.00 W —¼ E By. sec. 22	24	8	6	1910.6	25 42·7	25 47 8	"
30.00 N. ¼ N by sec. 23	24	8	6	1910.6	26 48·9	26 54·0	W. J. Deans.
12.00 W —center sec. 26	24	8	6	1910.6	26 21·4	26 22·5	"
16.00 N.—N.E. cor. sec. 22	24	8	6	1910.6	26 22·0	26 23·1	"
40 00 W " 13	24	8	6	1910.7	26 02·8	26 14·8	"
40 00 W.— " 12	24	8	6	1910.7	25 50·0	25 53·0	"
Center section 13	24	8	6	1910.7	25 57·8	25 58·8	"
30.00 W.—center section 13	25	8	6	1910.6	26 11·1	26 11·2	D. A. Smith.
40 00 W.—N.E. cor. sec. 1	25	8	6	1910.6	26 09·8	26 11·9	"
30.00 E.— " 13	25	8	6	1910.6	25 35·0	25 36·1	"
60.00 W.— " 1	25	8	6	1910.7	25 20·9	25 21·2	"
1 40 N.—Center sec. 1	26	8	6	1910.7	26 31·0	26 31·8	P. B. Street.
20.09 W.—N.E. cor. sec. 36	56	8	6	1909.7	27 44·7	27 49·7	A. H. Hawkins.
58.84 W.— " 36	56	8	6	1909 7	27 39·0	27 33·0	"
53.72 W.— " 33	56	8	6	1909.7	27 26·8	27 25·8	"
48 14 W.— " 34	56	8	6	1909 7	27 22·5	27 30·5	"
10.00 W.— " 35	56	8	6	1909 7	27 41·9	27 42·9	"
17.63 W.— " 31	64	8	6	1909 8	28 18·8	28 17·5	G. McMillan.
At " 33	70	8	6	1911.7	28 44·8	28 39·8	G. J. Lonergan.
At S.E. cor. sec. 3	71	8	6	1911 7	29 52·4	29 50·4	"
At N.E. cor. sec. 22	19	9	6	1911.7	25 58·4	25 54·7	M. P. Bridgland.
At " 15	19	9	6	1911.7	25 56·9	25 53·2	"
At " 16	19	9	6	1911.8	26 04·1	26 01·1	"
32 00 W.— " 17	20	9	6	1909.3	26 01·9		T. H. Plunkett.
42 00 W.— " 17	20	9	6	1909.3	25 45·8	25 52·0	"
10.00 W.— " 31	22	9	6	1910 6	25 57·6		L. D. N. Stewart.
12 00 S — " 31	22	9	6	1910 7	25 18·4	25 19·2	"
At N.E. cor. sec. 28	22	9	6	1910.7	25 46 8	25 46·8	"
15 00 S — " 33	22	9	6	1910.7	26 16·7	26 15·7	"
2.00 N.— " 5	23	9	6	1910.6	25 23·4	25 28·5	"
32.00 S.— " 15	23	9	6	1910.8	25 23·7	25 27·8	"
32 00 S. — " 15	23	9	6	1910.8	25 32·6	25 31·7	"
40.00 W.— " 31	68	9	6	1909.5	27 33·1		G. McMillan.
11 21 E — " 32	88	9	6	1911 9	31 11·6	31 07·1	"
7.57 E.— " 33	88	9	6	1911 9	31 09·7	31 05·2	"
40 25 S.— " 18	19	10	6	1909.3	25 29·1		T. H. Plunkett.
At S.E. cor. sec. 6	19	10	6	1909.4	25 51 9	25 55·8	"
At N.E. " 4	20	10	6	1911.8	25 30·9	25 25·9	M. P. Bridgland.
40 50 W.—S. E. " 4	20	10	6	1911.8	26 01·0	26 00·0	"
At N.E. " 9	20	10	6	1911 8	25 50·1	25 49·1	"
At " " 10	20	10	6	1911.8	25 36·2	25 34·2	"
At " " 11	20	10	6	1911.8	25 48·8	25 46·8	"
40 25 S.— " " 6	20	10	6	1911.8	25 52·4	25 54·4	"
At " " 33	21	10	6	1910.5	25 46·8	25 51·6	W. J. Deans.
20 00 S—Center sec. 33	22	10	6	1910.9	25 24·0	25 22·4	L. D. N. Stewart.
15 00 S.—N.E. cor. sec. 33	22	10	6	1911.0	25 50·4	25 46·3	"
40.00 W.— " 6	22	10	6	1910.3	25 35·7	25 41·9	W. J. Deans.
10 00 E.—Center sec. 7	22	10	6	1910.4	25 36·8	25 35·7	"
10.00 E.— " 7	22	10	6	1910.4	25 26·4	25 32·3	"
40 00 N —N.E. cor. sec. 6	22	10	6	1910.4	25 27·7	25 32·6	"
At " 6	22	10	6	1910.4	25 39·8	25 44·7	"
At " 7	22	10	6	1910.4	25 32·0	25 36·9	"
40 00 W — " 7	22	10	6	1910.4	25 30·9	25 36·8	"
10 00 W.—¼ post E. by sec. 18	22	10	6	1910.4	25 26·3	25 30·4	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
65.61 W.—N.E. cor. sec. 17	22	10	6	1910.4	25 35·8		W. J. Deans.
65.61 W. " 17	22	10	6	1910.4	25 38·1	25 44 2	"
40.00 W.— " 17	22	10	6	1910.4	25 37·2	25 43·3	"
57·54 N.— " 7	22	10	6	1910.4	25 36·9	25 41 0	"
40 00 W — " 4	22	10	6	1910.5	25 45·7	25 49·5	"
20 00 W.— " 4	22	10	6	1910.5	25 34·8	25 39 6	"
30.00 S.— " 5	22	10	6	1910.5	25 34·2	25 40·0	"
40.00 N.— " 5	22	10	6	1910.5	25 40 5	25 43·9	"
At " 7	23	10	6	1910.5	26 16·9	26 18·3	T. H. Plunkett.
At N.E. cor. N.W. ¼ sec. 22	23	10	6	1910.4	26 17·4	26 11 3	"
At " S.E. ¼ sec. 9	23	10	6	1910.4	25 39·2	25 44·1	"
At " sec. 15	23	10	6	1910 4	25 50 6	25 52·5	"
10.00 S.—¼ post E. by sec. 14	23	10	6	1910 5	25 33·3	25 31·1	"
32.40 N.—N.E cor. sec. 11	23	10	6	1908 5	25 11·2	25 21·5	E. W. Robinson.
28.00 W.— " 31	64	10	6	1910 4	27 15·4	27 13·9	G. McMillan.
65.00 W.— " 31	68	10	6	1909 5	28 12 0	28 09 6	"
44.69 E.— " 31	88	10	6	1911.9	32 39·1	32 37·6	J. R. Akins.
13.37 E.— " 34	88	10	6	1911 9	31 41·7	31 38·2	"
13.95 E.— " 36	88	10	6	1911 9	31 34·0	31 30·5	"
35.00 W.—¼ on E. by sec. 14	22	11	6	1910.4	26 01 4	26 04·3	G. H. Blanchet.
44.00 N.—N.E. cor. sec. 11	22	11	6	1910 3	25 27·9	25 33·1	"
At " 13	23	11	6	1910.5	25 43 5	25 46·9	T. H. Plunkett.
25 00 E —Center sec. 23	23	11	6	1910.5	26 06 6	26 08 0	"
3.00 W.—N.E. cor. sec. 28	25	11	6	1909.4	26 19·7	26 14·4	E. W. Robinson.
21.00 E.— " 28	25	11	6	1909.4	26 16 0	26 19 7	"
5.00 S.—N.E. cor. sec. 13	25	11	6	1909.4	25 55.7	26 00 4	E. W. Robinson..
40.00 S.— " 13	25	11	6	1909.4	26 00.4	25 55 1	"
Centre of section 10	25	11	6	1909.3	26 14.3	26 14 3	"
" 10	25	11	6	1909 3	26 09.6	26 17.6	"
" 7	25	11	6	1909.3	26 16.9	26 11 9	"
" 7	25	11	6	1909 3	26 11.2	26 21.2	"
41.00 W.—N.E. cor. sec. 30	25	11	6	1909 3	26 19.9	26 27.9	"
47.85 W. " 32	64	11	6	1910 5	27 12.9	27 17.1	G. McMillan.
35 00 W — " 35	68	11	6	1909 5	28 15 6	28 21.2	"
37 09 E.— " 34	88	11	6	1911 8	32 57.0	32 51.8	J. R. Akins.
75.00 E.— " 35	88	11	6	1911.8	32 40.7	32 35.5	"
60.58 E.— " 36	88	11	6	1911 8	32 34.7	32 30.5	"
14.34 S.—Centre sec. 18	23	12	6	1910 6	26 48.5	26 50.1	T. H. Plunkett.
3.00 N.—N.E. cor. sec. 14	25	12	6	1909 3	26 25.4	26 20.6	E. W. Robinson.
30.00 S.— " 14	25	12	6	1909 3	26 18.1	26 27.3	"
3.00 W.— " 25	25	12	6	1909 3	26 24.8	26 21.8	"
29.46 W.— " 34	68	12	6	1909 5	29 20.3	29 21 9	G. McMillan.
1.00 W.—¼ Post N. By. sec. 13	17	13	6	1911 5	24 42.1	24 44.3	C. H. Taggart.
20 00 W.—N.E. cor. S.E. ¼ sec. 4	22	13	6	1910 7	26 59 7	26 59.7	T. H. Plunkett.
10 00 W.— " N.W. " 4	22	13	6	1910.7	26 32.6	26 30.6	"
20.00 E.—N.E. cor. sec. 32	21	13	6	1910.7	26 26.6	26 27.6	"
13.07 W — " 34	64	13	6	1910 5	28 54.1	28 54.9	G. McMillan.
20.00 W.— " 34	68	13	6	1909 5	30 44.2	30 47.4	"
58.59 W.— " 33	80	13	6	1911 3	32 11.9	32 10 3	"
51.00 S.— " 13	83	13	6	1911.4	32 47.7	32 46.5	O. Rolfson.
17.00 S.— " 36	84	13	6	1911 4	33 17.1	33 16.9	"
At N.E. cor. sec. 13	85	13	6	1911.3	33 19.6	33 30.7	J. R. Akins.
69.06 N.—N.E. cor. sec. 24	85	13	6	1911 4	33 19.5	33 16 3	"
36.74 N.— " 36	85	13	6	1911 4	33 14.8	33 14.6	"
39.76 N.— " 1	86	13	6	1911 4	33 12.1	33 10.9	"
31 50 S.— " 13	86	13	6	1911.4	33 10.2	33 10.0	"
40.50 N.— " 24	86	13	6	1911 4	33 10.1	33 10 9	"
22.30 S.— " 25	86	13	6	1911 4	33 08.1	33 05.9	"
At " 36	86	13	6	1911 4	33 08.5		"
53.59 W.— " 36	86	13	6	1911.4	33 07.9	33 07 7	"
25.00 N.— " 12	87	13	6	1911.4	33 07.9	33 10.7	"
29.50 N.— " 12	87	13	6	1911 4	33 16 3		"
56 30 S.— " 24	87	13	6	1911 4	33 18.1	33 18.9	"
5.00 N.— " 25	88	13	6	1911 4	33 46.1	33 46.9	"
39.48 N.— " 12	88	13	6	1911 4	33 37.0	33 36 8	"
51.00 N.— " 13	88	13	6	1911 4	33 38.2	33 40.0	"
3.00 S.— " 21	16	14	6	1911 3	21 56.7	21 55.1	J. E. Ross.

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer.
					° ′	° ′	
At ¼ cor. N. By. sec. 34.....	17	14	6	1911 3	19 52.8	19 53.9	J. E. Ross.
60.00 S.—N. E. cor. sec. 32	77	14	6	1911.7	31 54.8	31 51.8	G. J. Lonergan
8.00 S.— " 31.....	77	14	6	1911.7	31 42.8	31 40.8	"
50.00 S.— " 31.....	78	14	6	1911.7	32 10.3	32 07.3	"
5.00 S.— " 7.....	79	14	6	1911.7	32.17.2	32 14.2	"
61.00 W.— " 34	80	14	6	1911.3	32 07.1	32 11.5	G. McMillan.
8.95 W.— " 34	84	14	6	1911.4	32 58.6	33 00.0	O. Rolfson.
72 33 W.— " 32.....	84	14	6	1911.4	32 15.6	32 17.0	"
56 22 W.— " 31.....	84	14	6	1911.4	32 17.8	.....	"
23.00 W.—S.E. cor. sec. 13.....	16	15	6	1911.3	25 29.9	25 29.3	J. E. Ross.
43.00 E.—N.E " 33.....	17	15	6	1911.5	27 37.2	27 38.3	C. H. Taggart.
At N.E. cor. sec. 16.....	19	15	6	1911.4	27 05.9	27 05.2	J. E. Ross.
7.00 E.—N.E. cor. sec. 2.....	21	15	6	1910.7	25 37.6	25 41.0	R. D. McCaw.
20.00 W.— " 36..... ..	77	15	6	1911.7	31 35.3	31 32.3	G. J. Lonergan.
At N.E. cor. sec. 24	78	15	6	1911.7	31 50.3	31 47.3	
68.00 W.—N.E. cor. sec. 32.	80	15	6	1911.3	32 01.1	32 05.5	A. McMillan.
56.38 W.— " 34..... ..	84	15	6	1911.5	32 11.8	32 13.9	O. Rolfson.
79.36 W.— " 31.....	84	15	6	1811.5	31 47.0	31 48.7	"
1.50 W.— " 22..... ..	16	16	6	1911.5	26 54.9	26 56.0	C. H. Taggart.
30.00 W.—S.E. " 24.....	16	16	6	1911.9	27 21.7	27 17.3	"
3.00 S.—N.E. " 32.....	21	16	6	1910.8	26 17.0	26 14.1	R. D. McCaw.
73 00 W.— " " 33..... .	80	16	6	1911.3	30 24.7	30 25.8	G. McMillan.
2.44 W.— " " 34	84	16	6	1911.5	31 36.3	31 38.5	O. Rolfson.
2.44 W.— " " 34.....	84	16	6	1911.5	31 49.2	31 43.4	"
2.44 W.— " " 34..... ..	84	16	6	1911.5	31 37.9	31 40.1	"
27 13 W.— " " 35	88	16	6	1911.5	31 20.7	31 21.9	J. R. Akins.
63.07 W.— " " 35.	88	16	6	1911.5	31 22.0	31 24.4	"
57.02 W.— " " 34	88	16	6	1911.5	31 32.7	31 36.9	"
69.45 W.— " " 31	88	16	6	1911 5	31 49.1	31 53.3	"
6 00 N.— " " 27	16	17	6	1912 0	26 18.5	26 13.8	C. H. Taggart.
6.00 N.—¼ cor. E. by sec. 18....	22	17	6	1910.4	27 22.1	27 29.0	J. E. Ross.
13.00 W.—N.E. cor. sec. 34.....	80	17	6	1911.4	30 34.1	30 32.9	G. McMillan.
80.54 W.—N.E. cor. sec. 36	84	17	6	1911.5	31 21.0	31 23 2	O. Rolfson.
12.80 W.— " 36.....	88	17	6	1911 5	32 04.2	32 02.4	J. R. Akins.
6 53 W.— " 34.....	88	17	6	1911.6	31 51.6	31.51.5	"
37.00 W.— " 31	88	17	6	1911.6	32 09.3	32 08.2	"
15.00 E.— " 36.....	17	18	6	1910 9	25 54.9	.....	J. E. Ross.
40.25 S.—N. E. cor. sec. 11	18	18	6	1910.8	25 22.1	25 21.3	"
40.00 W.— " " 14	19	18	6	1910.9	23 33.1	23 34.0	"
2.00 E.— " " 33	21	18	6	1910.8	28 02.9	28 04.0	R. D. McCaw.
10.00 E.— " " 33	21	18	6	1910.8	25 01.4	25 01.5	"
37.00 N., 28.00 W.—N. E. cor. 31....	21	18	6	1910.4	24 38.4	24 41.3	J. E. Ross.
5.00 S.—Centre sec. 20..	21	18	6	1910.4	24 30.8	24 32.7	"
75.42 W.—N. E. cor. sec. 34 ..	84	18	6	1911.6	32 03 9	31 56.8	O. Rolfson.
75.42 W.— " " 34 .	84	18	6	1911.6	31 40.0	31 46.9	"
75.42 W.— " " 34 .	84	18	6	1911.6	31 46.6	31 45.5	"
75.42 W.— " " 34.. .	84	18	6	1911 6	31 48.8	31 47.7	"
30.06 W.—N. E. cor. sec. 35.....	88	18	6	1911.6	31 55.7	31 58.6	J. R. Akins.
45.61 W.— " " 33.....	88	18	6	1911.6	31 58.8	32 00.7	"
20.75 W.— " " 31..... ..	88	18	6	1911.6	31 45.1	31 46.6	"
68.10 W.— " " 31	88	18	6	1911.6	31 46.8	31 47.3	"
At Sta. II.—Road Tra. sec. 35.....	17	19	6	1912.0	25 32.2	25 25.5	C. H. Taggart.
32.00 E.—N. E. cor. sec. 27.....	17	19	6	1910.6	25 14.7	25 13.0	R. D. McCaw.
34.00 W.— " " 22	21	19	6	1910.4	26 09.8	26 15.9	J. E. Ross.
Sta. O. Watching Ck. Traverse S. W. part sec. 12.....	22	19	6	1910.8	29 23 5	29 25.6	R. D. McCaw.
10.00 N.—Sta. 2 in N. E. part 24.....	22	19	6	1910.8	25 18.7	25 18.4	"
76.88 W.—N. E. cor. sec. 33.....	84	19	6	1911.6	31 32.5	31 32.0	O. Rolfson.
4.28 W.—N. E. cor. sec. 34.....	88	19	6	1911.6	31 32.8	31 35.3	J. R. Akins.
47.70 W.— " " 33.....	88	19	6	1911.6	31 33.1	31 31.6	"
5.00 S.— " " 29.....	17	20	6	1910.6	25 28.6	25 31.7	R. D. McCaw.
7.00 N.— " " 25.....	21	20	6	1910.4	25 47.0	25 53.1	J. E. Ross.
At 1/4 cor. E. by. sec. 1.....	22	20	6	1910.4	28 52.4	28 58.5	"
34.00 S.—N. E. cor. sec. 32.	23	20	6	1910.7	26 34.0	26 35.8	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination. Obs'd.	Declination. Reduced to 1912.0	Observer
35.00 S.—N. E. cor. sec. 16	24	20	6	1910.7	26 18.4	26 19.4	J. F. Ross.
34.21 W.— " " 34	84	20	6	1911.6	31 08.2	31 07.7	O. Rolfson.
21.00 W.— " " 35	84	20	6	1911 6	31 11.5	31 11 0	"
0.47 W.— " " 31	84	20	6	1911.6	31 05.8	...	"
53.08 W.— " " 33	84	20	6	1911 6	31 06.9	31 04 4	"
4.00 W.— " " 34	88	20	6	1911 6	31 08.2	31 09 7	J. R. Akins.
47.00 W.— " " 32	88	20	6	1911 6	31 14.4	31 14 9	"
10.00 N.— " " 2	22	21	6	1910.5	27 45.7	27 48 1	J. E. Ross.
At 1/4 cor. N. by. sec. 23	22	21	6	1910 6	26 11.7	26 17 8	"
25. 00 S.—N. E. cor. sec. 4	23	21	6	1910 6	25 44.0	25 48 1	"
20.00 S.— " 11	24	21	6	1910.7	27 01.4	27 03 9	
15.31 W.— " " 36	84	21	6	1911 6	31 15.3	31 14 8	O. Rolfson.
22.69 W.— " " 35	84	21	6	1911.7	31 09 1	31 06 3	"
70.98 W.— " " 33	84	21	6	1911.7	30 46.3	30 43 3	"
23.82 W.— " " 36	88	21	6	1911.6	31 30.9	31 31 4	J. R. Akins.
1.56 W.— " " 34	88	21	6	1911.6	31 39.8	31 38 3	"
31.32 W.— " " 33	88	21	6	1911.6	31 33.6	31 33 1	"
24.71 W.— " " 32	88	21	6	1911.6	31 47.4	31 44 9	"
69.62 W.— " " 31	88	21	6	1911.6	31 33.3	..	"
6.00 E.— " " 4	16	22	6	1910.5	25 44 0	25 47 4	R. D. McCaw.
12.00 S.— " " 13	19	22	6	1910.8	24 03 9	. .	J. E. Ross.
At " " 26	22	22	6	1910 6	27 32.1	. . .	"
25.00 W.— " " 25	23	22	6	1910.6	26 53.8	. . . .	"
10.78 W.— " " 34	84	22	6	1911.7	31 20.9	31 17.9	O. Rolfson.
54.20 W.— " " 33	84	22	6	1911 7	31 50 8	31 47 8	"
34.78 N.—N. E. cor. sec. 35	88	22	6	1911.7	31 52.8	31 53 0	J. R. Akins.
72. 50W.— " " 34	88	22	6	1911.7	31 50.9	31 48 1	"
1.50 W.—centre sec. 1	14	23	6	1910 6	25 17.0	25 22 1	R. D. McCaw.
40.25 N.—N. E. cor. sec. 26	15	23	6	1910.5	23 40.9	23 44 3	"
1.00 W.— " " 1	17	23	6	1910 6	25 21.9	. . .	"
20.50 N.— " " 36	20	23	6	1910.8	25 33.0	25 33 1	J. E. Ross.
38.90 W.— " " 31	84	23	6	1911.7	31 33.5	31 25 5	O. Rolfson.
38.90 W.— " " 31	84	23	6	1911 7	31 31.3	31 31 3	"
38.90 W.— " " 31	84	23	6	1911.7	31 23.6	31 22 6	"
38.90 W.— " " 31	84	23	6	1911.7	31 28.4	31 24.4	"
38.90 W.— " " 31	84	23	6	1911.7	31 42.1	31 35.1	"
34.56 W.—N. E. cor. sec. 36	88	23	6	1911.7	31 42.9	31 41 1	J. R. Akins.
47.80 W.— " " 35	88	23	6	1911.7	31 40.3	31 40 3	"
78.00 W.— " " 35	88	23	6	1911.7	31 42.2	31 39 2	"
14.24 W.— " " 33	88	23	6	1911.7	31 46.9	31 43 9	"
15.00 N.— " " 23	18	24	6	1910.5	25 43 6	25 45 4	R. D. McCaw.
48.78 W.— " " 36	84	24	6	1911 7	31 45.2	31 38 2	O. Rolfson.
48.78 W.— " " 36	84	24	6	1911.7	31 37.0	31 38 0	"
36.91 W.— " " 32	84	24	6	1911.7	31 32.8	31 31 8	"
70.36 W.— " " 35	88	24	6	1911.7	32 00.5	31 55 5	J. R. Akins.
64.17 W.— " " 34	88	24	6	1911.7	32 00.2	31 57 2	"
31.80 W.— " " 31	88	24	6	1911.7	32 08 9	32 05 9	"
17.18 W.— " " 36	88	24	6	1911.7	31 52.8	31 54 8	"
17.18 W.— " " 36	88	24	6	1911.7	32 04.1	31 56 1	"
40.00 N.— " " 12	17	25	6	1910 5	27 43.2	27 51 6	R. D. McCaw.
8.00 W.— " " 19	23	25	6	1910.9	26 46.2		T. H. Plunkett.
At N.E. cor. N.W. ¼ sec 26	23	25	6	1910.9	26 07·5	26 06 2	T. H. Plunkett.
27.61 W.—N.E. cor. sec. 36	84	25	6	1911 8	31 12·8	31 06 8	O. Rolfson.
27.61 W.—N.E. " 36	84	25	6	1911.8	31 07·0	31 07 0	"
27.61 W.—N.E. " 36	84	25	6	1911 8	31 09·2	31 05 2	"
71 82 W.—N.E. " 33	84	25	6	1911 8	31 04·2	30 53 2	"
71.82 W.—N.E. " 33	84	25	6	1911 8	30 56·2	30 56·2	"
9.58 N.—S. W. " 6	87	25	6	1911 8	31 50·9	31 45 9	L. Brenot.
44.80 N.—N.W. " 18	87	25	6	1911·8	32 07·8	32 03 8	"
41.00 N.—N.W " 31	87	25	6	1911·8	32 05 6	. . .	"
23.66 W.—N.E. " 36	88	25	6	1911·7	32 02 3	31 59·3	J. R. Akins.
23.93 W.—N.E. " 28	88	25	6	1911 7	32 19·8	32 18 8	"
76.23 W.—N.E. " 29	88	25	6	1911·7	32 26·8	32 22·8	"
5.00 N.—N.W. " 2	82	26	6	1911·7	30 51·5	30 46 7	L. Brenot.
53.00 N.—N.W. " 23	82	26	6	1911·7	30 54·7	30 51 9	"
26.56 N.—N.W. " 24	83	26	6	1911·7	30 51 0	30 47·0	"
69.13 N.—N.W. " 13	84	26	6	1911·7	30 56·0	30 51·0	"

TABLE No. 4—*Continued.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912.0	
					° ′	° ′	
27.42 N.—N.W. cor. sec. 25	85	26	6	1911.7	31 17·7	31 15·0	"
40.00 S.—N.E. " 34	2	29	6	1911.6	24 28·5	24 25·0	W. J. Deans.
At centre sec. 35	2	29	6	1911.6	24 16·3	24 15·3	"
At N.E. cor. sec. 34	2	29	6	1911.6	24 27·8	24 26·3	"
9.60 N. ¼ post—N. by. sec. 35	2	29	6	1911·7	24 16·2	24 19·4	"
At S.E. cor. sec. 1	3	29	6	1911·6	24 19.1	24 18·6	"
At S.E. cor.—T.B. 547, sec. 4	7	29	6	1911·8	23 51·6	23 48·6	A. L. Lighthall.
At N.E. cor sec. 12	7	30	6	1911·8	23 40·4	23 35·2	"
20.00 W.—S.E. cor. sec. 1	3	3	7	1910·7	25 45·4	25 46·4	"
19.00 W.—¼ post E. by. sec. 1	4	3	7	1910·7	24 36·2	24 39·2	"
20.00 E.—N.E. cor sec. 19	6	4	7	1911·6	25 13·9	25 14·4	"
25.00 S.—N.E. " 20	6	4	7	1911·6	26 19·3	26 20·8	"
35.00 S.—N.E. " 20	6	4	7	1911·6	26 59·3	26 57·8	"
At N.E. cor. sec. 3	4	5	7	1911·8	23 50·6	23 53·6	"
20.00 S.—N.E. cor. sec. 27	4	5	7	1911·8	24 03·1	23 59·1	"
At centre sec. 2	4	5	7	1911·8	23 47 1	23 45·1	"
40.00 W.—Centre sec. 17	5	5	7	1911 7	24 28·9	24 25 9	"
50.00 E.— " 8	5	5	7	1911·7	23 20·2	23 18·2	"
20.00 W.— " 9	5	5	7	1911 7	24 39·7	24 39·7	"
At centre sec. 34	6	5	7	1911·5	25 54 9	25 58 0	"
5.00 S.—Centre sec. 35	6	5	7	1911 5	26 33 8	26 35·0	"
60.00 E.— " 26	6	5	7	1911 5	29 40·1	29 43·3	"
5.00 N.— " 24	6	5	7	1911 6	24 08·1	24 10·0	"
26.00 E.— " 24	6	5	7	1911 6	25 54·2	25 58 1	"
71.00 E.— " 24	6	5	7	1911·6	26 02·0	26 03·9	"
60.00 S.— " 26	6	5	7	1911·7	28 21·6	28 20·0	"
6.00 N. 8.00 W.—¼ cor. S. by. 35	6	5	7	1910·8	26 27·3	26 23·0	"
At centre sec. 4	7	5	7	1911·4	26 03 1	26 06·5	"
10.00 W. 2.00 N.—¼ cor. E. by. 16	6	7	7	1910·3	24 50·3	24 51 7	"
40.00 W.—N.E. cor. sec. 11	15		E.C.	1911·9	24 12·3	24 10 8	"
At N.E. cor. sec. 3	15		E.C.	1911·9	23 22·7	23 20·2	"
At N.E. " 30	17		E.C.	1911·4	23 16·1	23 17·5	W. J. Deans.
At ¼ post E. by. sec. 31	17		E.C.	1911·4	23 31.8	23 34·2	"
At ¼ post N. " 30	17		E.C.	1911·5	23 19.2	23 23·3	"
At ¼ post E. by sec. 31	17		E.C.	1911 5	23 37.4	23 39.5	W. J. Deans.
6.00 W.—N.E. cor. S.E. ¼ sec. 30	17		"	1911.5	22 12.2	22 16.3	"
10.00 N. ¼ post N. Ry. sec. 30	17		"	1911.7	23 11.0	23 09.0	"
30.00 W.—N.E. cor. sec. 31	17		"	1911.7	23 32.4	23 30.4	"
At Centre " 31	17		"	1911 7	22 59.6	22 55.6	"
At N.W. cor. sec. 31	17		"	1911 7	23 35.9	23 32.9	"
50.00 S.—N.E. cor. sec. 6	18		"	1911 7	22 38.8	22 42.8	"
20.00 S.— " " 6	18		"	1911.7	22 45.0	22 42.0	"
20.00 S.— " " 6	18		"	1911.7	22 55.9	22 47.9	"
20.00 N.—¼ post S. by sec. 6	18		"	1911.7	23 37.6	23 33.6	"
30.00 W.—N.E. cor. sec. 6	18		"	1911.7	23 24.5	23 24.5	"
At —S.E. " 6	18		"	1911.7	23 20.2	23 17.2	"
15.00 S. ¼ sec. cor. N. by 13	18		"	1910.4	24 35.7	24 38.8	A. L. Lighthall.
15.00 S. N.E. cor. sec. 19	18		"	1910.5	24 33.0	24 35.3	"
10.00 S. ¼ post E. by sec. 27	20		"	1911 8	23 56.0	23 53.0	W. J. Deans.
40.36 N.—N.E. cor. sec. 21	20		"	1911.8	23 55.4	23 52.4	"
20.00 W.—¼ post E. by sec. 24	20		"	1911.8	23 51.8	23 48.8	"
20.00 E.— " " 22	20		"	1911.8	24 13.6	24 08.6	"
50.00 S.—N. E. cor. sec. 24	20		"	1911.8	23 53.0	23 49.0	"
2.00 S.—Centre sec. 23	20		"	1911.8	23 51.7	23 48.7	"
16.00 N.— " " 17	20		"	1911.8	23 52.5	23 49.5	"
3.00 N.—N.E. cor. sec. 18	20		"	1911.8	23 44.6	23 40 6	"
52.00 S.— " " 21	20		"	1911.8	23 56.5	23 52.5	"
20.00 E.— " " 17	20		"	1911.8	23 48.1		"
2.00 S.—S.W. " 5	22		"	1911.6	23 13.4	23 13.9	"
40.00 W.—S.E. " 6	22		"	1911.6	23 14.0	23 15.5	"
At —N.E. " 19	22		"	1911.5	24 21.2	24 24.4	"
At — " " 24	22		"	1911 6	23 37.5	23 36.4	"
At — " " 24	22		"	1911.6	23 35.3	23 34.2	"

TABLE No. 4—*Concluded.*

Place.	Tp.	Rge.	Mer.	Date.	Declination.		Observer.
					Obs'd.	Reduced to 1912 0	
					° ′	° ′	
5.00 N.—S.E. cor. sec. 5	22	..	E.C.	1911 6	23 27.5	23 27.0	W. J. Deans.
20.00 W.— " " 5	22	.. ..	"	1911.6	23 32 3	23 33 8	"
10.00 W. Centre sec. 19.	25	.....	"	1911.6	23 29.8	23 33.7	"
20.00 W.—N.E. cor. sec. 20	25	....	"	1911.6	23 34 2	23 36.1	"
At — " " 20	25	.....	"	1911.6	23 36.8	23 37.7	"
28.00 N. 34.00 E.—N.E. cor. sec. 16.	40	.....	"	1910.8	22 52.3	22 57.9	A. L. Lighthall.
20.00 N.—S.E. cor. sec. 1.....	41	.....	"	1910.9	28 08.8	28 07.2	"
27.20 N.—N.E. " 27.....	2	1	W.C.	1911.4	24 19.2	24 20 0	W. J. Deans.
At —N.W. " 34.....	2	1	"	1911.4	24 14.8	24 09.6	"
22.40 W.—N.E. " 34.....	2	1	"	1911.4	24 13.5	24 20.3	"
N.E. cor. L.S. 13, sec. 24 of Tp.....	39	.....	"	1910.3	26 31.4	26 34.6	T. H. Plunkett.
" " " 24 "	39	....	"	1910.3	26 28.9	26 32.1	"
40.00 E.—N.W. cor. sec. 30.....	39	.....	"	1910.4	26 28.5	26 32.4	A. L. Lighthall.

APPENDIX No. 51

THE COPYING CAMERA

OF THE

SURVEYOR GENERAL'S OFFICE

BY

E. DEVILLE, LL.D.

Surveyor General of Dominion Lands

OTTAWA
GOVERNMENT PRINTING BUREAU
1913

25b—15

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THE COPYING CAMERA

OF THE

SURVEYOR GENERAL'S OFFICE

PART I.—THE CAMERA.

1. General Features of Copying Cameras.

The evolution of the copying camera from the crude wooden box of the early days to the elaborate instrument now in general use is one of the many evidences of the progress of photography. Nowhere has photography proved more useful than in survey departments: apart from the printing of maps by the various processes of photo-lithography, photo-zincography and photo-engraving, the reductions, enlargements and other copies of maps and plans required by surveyors for field use or by draughtsmen for compiling other maps and plans, are now prepared by photography instead of being made by hand as formerly. The copying camera is accordingly an important adjunct of every survey office.

The land surveys of the Canadian Government now extend over some seven thousand townships, and the number is increasing every year. A plan of each township is printed for the administration and for the public. Every time further surveys are made in a township, and this happens frequently, a new plan has to be printed. The necessity of providing, without too great an increase in the photographic staff and equipment, for the publication of such a large number of township plans, and of the other maps and plans issued by the Survey Department, has developed a copying camera presenting some peculiar features, a description of which may prove of interest.

One of the first improvements in copying cameras was in the mode of suspension. It was found that the vibrations caused by the machinery always present in business buildings, or even by the street traffic, affected the sharpness of the negative; although the vibrations did not mar the appearance of a portrait, the quality of a line negative was seriously impaired. The vibrations were prevented at first by placing the camera and the board upon a cradle suspended by ropes from the ceiling. The board was fixed at one end and the camera moved to and fro upon rails on the cradle. The rope suspension is still in use, but is somewhat inconvenient; a better combination is to support the cradle by means of springs upon a stand, and this is the mode of suspension most frequently met with. So long as the camera is small, this suspension is convenient; the work of the process worker being, as a rule, of small size, this style fulfils his requirements. For the reproduction of maps, however, the conditions are different, because maps are frequently of large size. A large camera, with a board in proportion, and a spring cradle on a stand, would be

very unwieldy indeed, and most inconvenient in use. Such a combination is seldom found in survey departments, the trouble from vibrations being usually overcome by setting up the camera in a place far away from traffic and machinery. No such place was available here; the photographic office was on the top floor of a building in which lithographic presses were running, and some mode of spring suspension was imperative.

The solution adopted consists in suspending the cradle by springs from the ceiling, but instead of putting the camera and board on the cradle, they are placed underneath.

2. Camera of the Surveyor General's Office.

The board is fixed at one end of the cradle: the lens and plate are on two separate carriages sliding on two pairs of V rails. The rails for the plate carriage

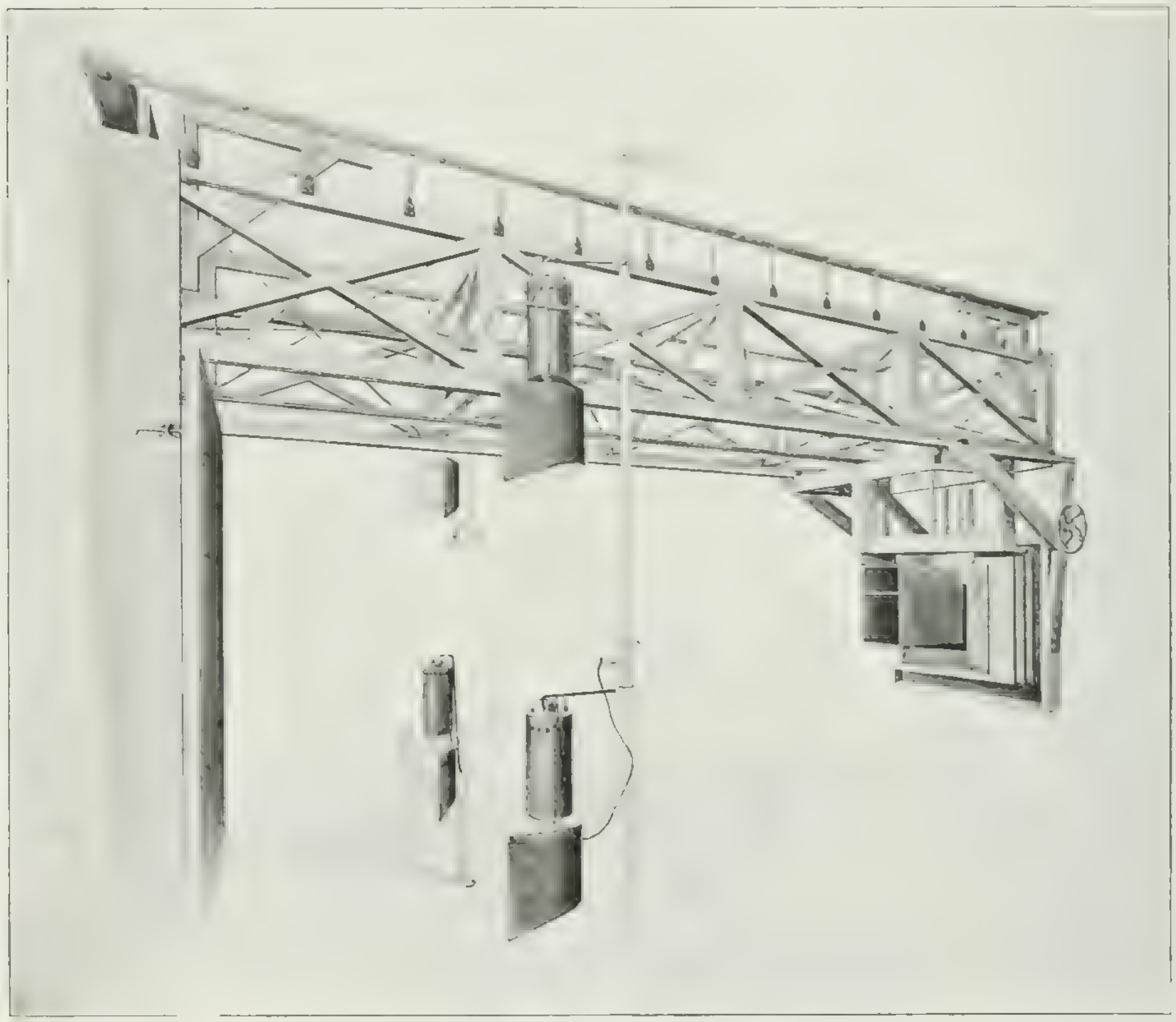


FIG. 1—Camera fitted with short bellows for great reduction.

are outside the cradle, those for the lens carriage are inside. The lens can be brought within ten inches of the plate (Fig. 1). Bellows suspended by chains from runners under the cradle can be inserted to give any camera extension needed

for enlarging (Fig. 2). Negatives for the offset lithographic press and for photographic printing are made with the camera so fitted. For half-tone and line engraving, and for printing from stones, the lens hood of the lens carriage is removed and a reverse camera substituted (Fig. 3).

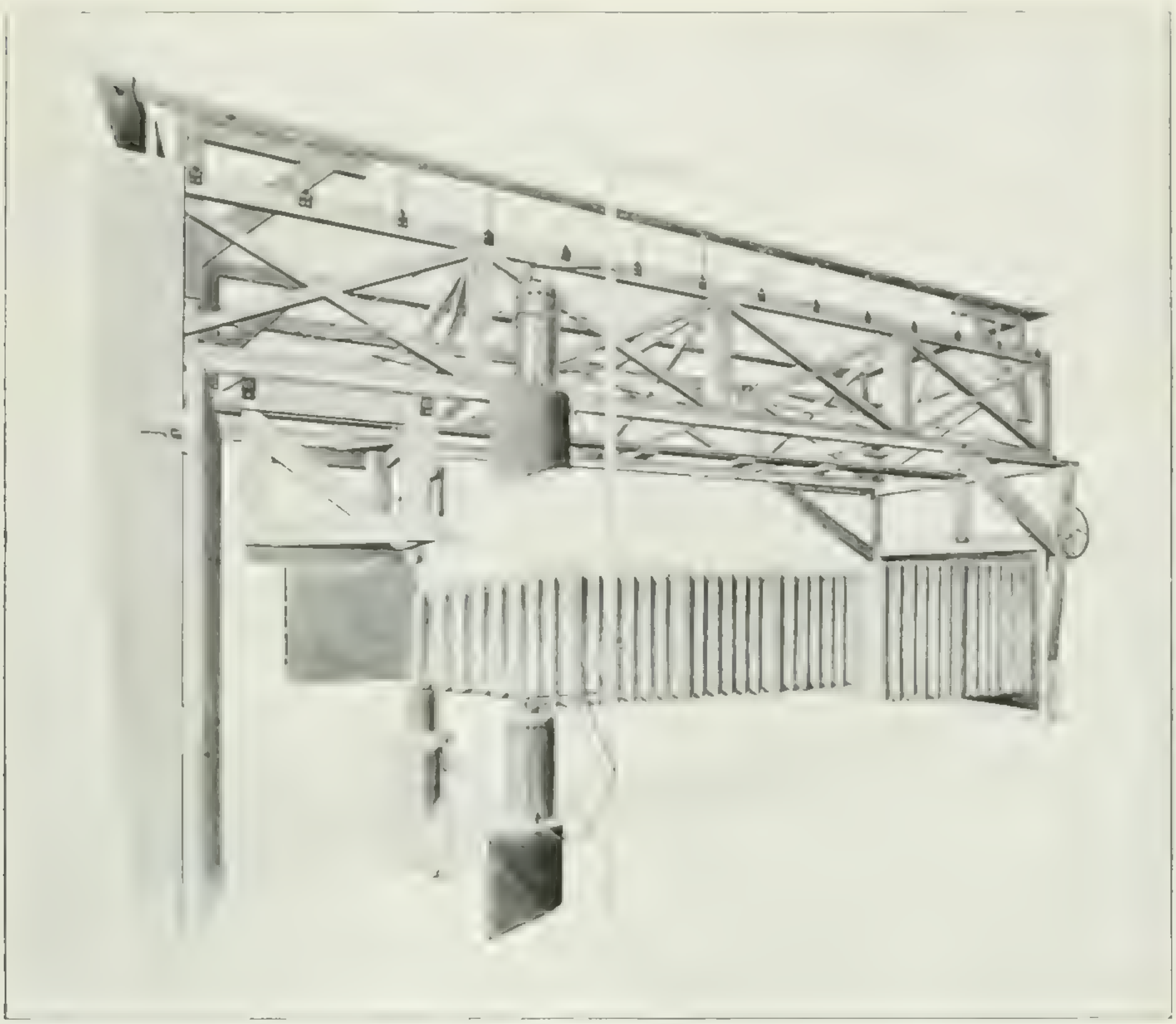


FIG. 2.—Camera fitted with long bed-bars for enlarging.

The cradle is fourteen feet long and four feet wide. The first cradle of this pattern, although very strong, was subject to torsional vibrations; it was replaced by the present cradle, which is wider, deeper and strongly braced by iron rods with turnbuckles. Absolute rigidity of the cradle is essential.

The swing of the whole apparatus, if suspended freely, would be inconvenient. It is limited by wooden arms bolted to the ceiling at both ends and extending inside of the cradle. Pieces of soft rubber, half an inch thick, are inserted between the arms and the cradle, thus limiting the swing without transmitting vibrations.

3. The Board.

Two uprights fixed at one extremity of the cradle are terminated at their lower ends by iron brackets upon which the weight of the board rests; it is attached to the

uprights by four adjusting screws. The surface of the board is tested with a straight edge; if warped, it can be straightened by means of crossbars and bolts acting upon the cleats. About eighty per cent of the originals are of one particular size (township plans); these are placed on the board behind a glass plate held at the four corners by bolts and nuts. The original is adjusted to correct position, after which

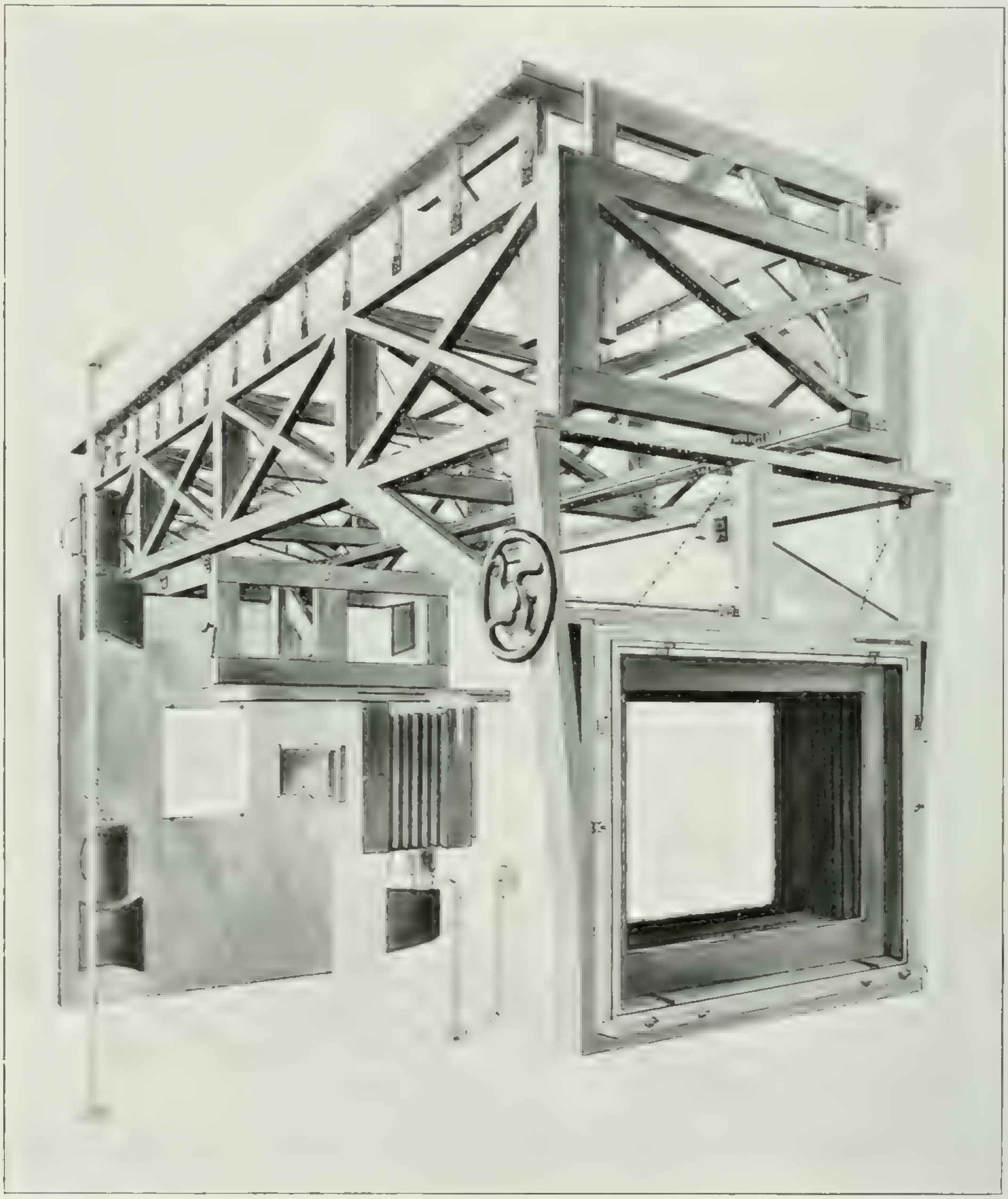


FIG. 3—Reverse Camera.

the nuts are tightened. The insertion of the glass plate shortens the optical distance from the lens by one-third the thickness of the plate; the board has to be moved that much farther away. Originals of other sizes are pinned to the board, the glass and bolts being removed.

Through the centre of the board two lines are drawn at right angles, approximately horizontal and vertical. Likewise the two middle lines, in the direction of the width and in the direction of the height, of the original to be reproduced, are indicated by short lines drawn on the border of the original. The latter is in correct position when its middle lines coincide with the lines of the board.

At the centre of the board is a hole through which a microscope or the telescope of an optical square can be inserted for adjusting the camera; it is closed by a plug when not in use.

4. The Lens Carriage.

The lens carriage slides on two pairs of steel shoes far enough apart to prevent wabbling; the motion is given by a rack and pinion through angle gear and a crank at the side of the carriage.

The lens board fits in a rebate at the bottom of a deep hood, the object of which is to keep stray light off the interior of the camera.

The bellows fit in another rebate at the back of the hood, where they are held by two turnbuttons. A lens of 33·7 inches focus is used for most of the work; for great reductions and for the reverse camera, a lens of shorter focus is employed.

The graduations for setting the carriages in position are on an enamelled hardwood rod, 1×3 inches, attached to the middle of the cradle, the pointers being fastened to the carriages. The lens carriage has two pointers, one for the direct camera and one for the reverse camera. Both pointers are adjustable, and can be clamped by screws when in correct position.

5. The Plate Carriage.

Sections of bellows of convenient size can be fitted up between the two carriages, providing camera extensions from 10 inches to 11 feet. They are fastened to each

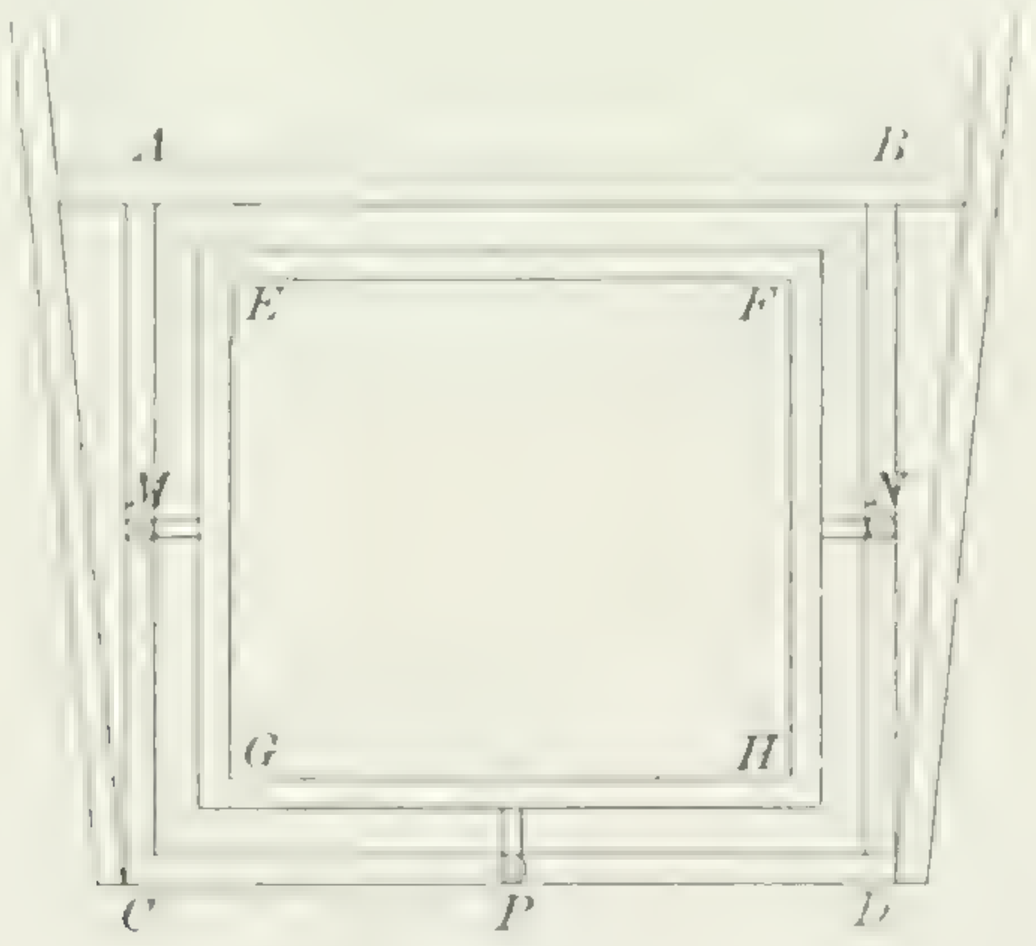


FIG. 4.—Frame of Plate Carriage.

other by hooks and are supported by chains hanging from runners under the cradle. The plate carriage, like the other one, has two pairs of steel runners; they slide

upon the outside V rails, the motion being given through a rack and pinion and angle gear by a large hand wheel.

The plate carriage consists of a rectangular frame, *A B C D* (Fig. 4), inside of which is another frame, *E F G H*, to which the plate-holder is attached. The inner frame is connected to the outer one by three trunnions, *M*, *N* and *P*. Each trunnion is on a steel plate which slides forwards and backwards in a steel groove by means of an adjusting screw. By turning the screw at *P*, the inner frame revolves around *M N* as an axis. By turning the screws at *M* and *N* in opposite directions, the inner frame revolves around the vertical through *P* as an axis. For moving the inner frame bodily forwards or backwards, parallel to itself, the three screws are turned in the same direction.

The four plate-holders are 24″ × 32″, 20″ × 24″, 16″ × 18″ and 10″ × 12″, respectively; they can all be attached to the inner frame in accurate register. The larger one, which is somewhat heavy, is moved about on a truck, with rubber tire wheels

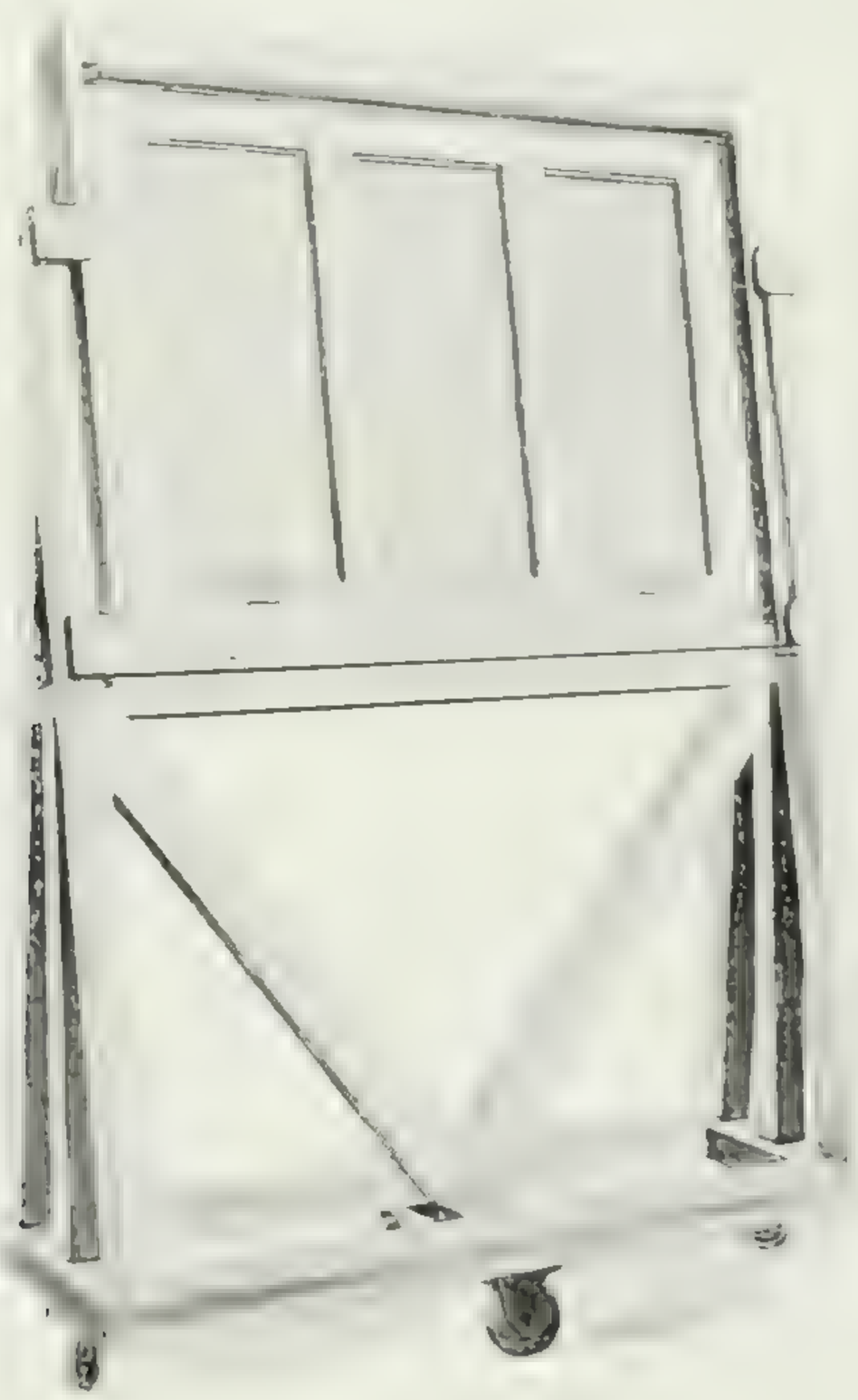


FIG. 5 Plate-holder Truck.

(Fig. 5), to which it is fastened by two turnbuttons and from which it is removed only for attaching to the camera. It remains on the truck in the dark room. When brought close to the plate carriage, a lift of a few inches brings it to its place on the camera.

The smaller holders are more easily handled; the operator always gives the preference to the smallest holder that will take in his plate.

Plates up to 20″ × 24″ are sensitized in a glass bath enclosed in a wooden case a little more than twice the height of the bath and inclined about ten degrees to

the vertical. The upper half of the case is closed by a sliding panel supported by a counterweight so adjusted that the panel stays either open or closed. Another counterweight heavier than the 20″ × 24″ plates, supports by means of a rope and pulley the dipper upon which the plate is placed for sensitizing. After coating the plate with collodion and putting it on the dipper, the panel is closed and the counterweight of the dipper is slowly lifted by hand from the lower shelf upon which it was resting, allowing the plate to descend into the bath, and is deposited upon an upper shelf when the plate is completely immersed. The plate is left four minutes in the bath and then the counterweight is taken from the upper shelf and slowly brought down to the lower shelf, withdrawing the plate from the solution and leaving the bottom of the plate upon the edge of the glass bath. The plate is allowed to drip for one or two minutes, the panel is opened and the plate transferred to the plate-holder. Up to the transfer of the plate to the plate-holder, the whole operation is performed in full daylight.

6. Reverse Camera.

The reverse camera, 18″ × 20″, is used with the smaller lens; the extension is 24 inches. The front is fixed, focussing being effected by moving the back by means of a double rack, pinion and crank. A graduated brass scale on the bed indicates the reduction.

The silvered glass reversing mirror fits snugly into the groove of a rectangular board connected to the mirror box by four adjusting screws, *A*, *B*, *C* and *D* (Fig. 6). By turning the screws *A* and *B* in opposite directions, the mirror revolves around a vertical axis through its centre. Likewise by turning the screws *C* and *D* in opposite

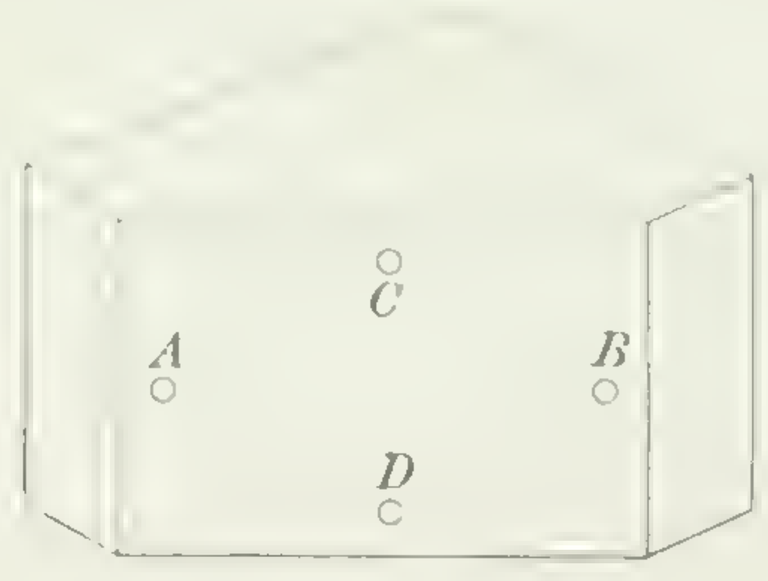


FIG. 6.—Mirror Box

directions, the mirror revolves around the horizontal line in its plane through its centre.

The equipment comprises two mirrors, one being in use while the other one is out for silvering. With proper care and provided it is slightly warmed before any attempt is made to polish it, the silvering is good for six months or more. Incidentally it may be mentioned that an optically plane mirror is an expensive article; many of those found in the trade are imperfect and spoil the definition of a good lens.

A feature of this style of copying camera is its adaptability to large sizes. A large plate holder, a few extra lengths of large bellows and a larger lens are all that

is needed. So far as the camera is concerned, the large plates are handled without any more trouble than the smaller ones. The size of the plate here has been limited to 24″ × 32″, merely because there is no occasion to use a larger plate.

7. Setting the Camera.

Two methods are available for setting a copying camera. By the first method the camera is adjusted at each operation so as to yield an image of a definite size and shape, which may or may not be an accurate reduction of the original. By the second method, the camera is adjusted once for all beforehand so as to yield in all cases an accurate reduction or enlargement of the original.

The first method is in general use and has some advantages. Let it be assumed, for instance, that a map has to be reduced to a rectangle 24″ × 30″. The operator rules on the ground glass a rectangle of that size, and endeavours in the usual manner to obtain an image filling approximately the rectangle so drawn. The next step is to bring one side of the image in coincidence with the corresponding side of the rectangle; this is done either by turning the board around an axis perpendicular to its face and by shifting it right or left and up or down, or by like motions of the camera. It is now found that the other sides of the rectangle do not fit, the shape of the image being an irregular quadrilateral; it has to be brought to correct shape by changing the inclination of the board to the axis of the camera. Every time an adjustment is made, it disturbs the preceding ones, which have all to be gone over again. To one without experience, the process is exceedingly tedious; like everything else, however, it is made easier by long practice, and some operators become in time very skilful. The main advantage of the method lies in the fact that, in some cases, it is possible to restore to correct proportions a drawing which has become distorted. Some kinds of paper, and especially tracing cloth, are affected by atmospheric conditions, and distortion occasionally becomes appreciable.

The advantage of the second method lies in its rapidity. The operator pins the original to the board, sets the two carriages by the scale to the reduction or enlargement marked on the job slip and exposes the plate. There is no focussing or twisting of the camera or board; in fact, no ground glass is used. This method was adopted by the office of the Surveyor General because the number of land survey plans to be reproduced is very great, and because the angles and lengths being marked in figures on the plans, scaling is unnecessary and a slight distortion would be immaterial. Moreover in an original properly cared for, distortion is seldom appreciable, and the most frequent case of distortion, that which is due to unequal expansion in the direction of and across the web of the paper, cannot be corrected by the adjustment of the camera.

8. Focussing.

Focussing is done with Carl Zeiss microscope (Fig. 7). This microscope, which has a power of 28 diameters, slides in an outer split sleeve terminated by a square base which can be applied against a glass plate. The coarse adjustment is effected by sliding the microscope in the outer sleeve till a distinct image is seen, and fastening it in that position by turning the milled screw ring at the top of the outer sleeve.

The fine adjustment is effected by screwing the body of the microscope in or out of an inner split sleeve, the second clamping ring (shown on the left of the 10 mm. division of the scale) having been released. The displacement of the microscope is read on the millimetre scale, the tenths of a millimetre being indicated by marks on the circumference of the inner sleeve and the hundredths easily estimated.

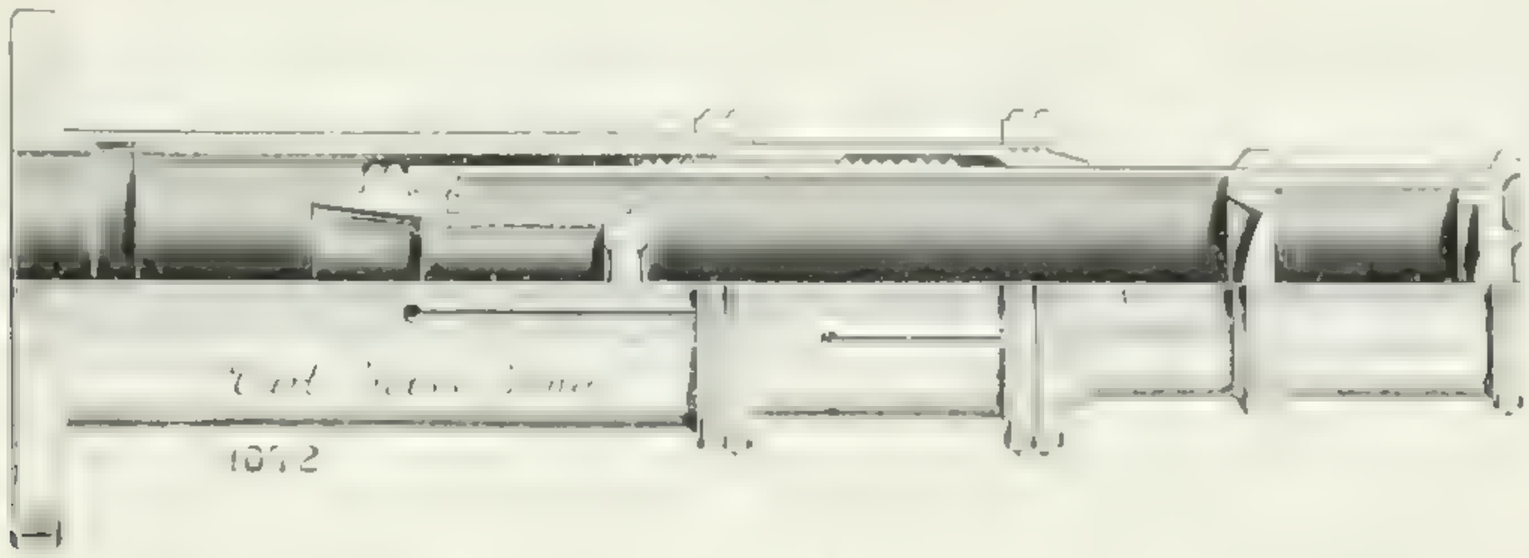


FIG. 7.—Focussing Microscope

For focussing the camera, a large piece of clear plate glass, perfectly plane, is selected, and a cross of two very fine lines is engraved in the centre with a diamond. The plate is inserted in the plate holder, engraved face towards the board, after removing the curtain and back of the holder. The base of the microscope is now applied against the back of the plate, it is set upon the engraved cross and the millimetre scale is read. The microscope is put against the plate again and is set this time upon the image of the original pinned to the board. The millimetre scale is read a second time. The difference of the two readings is the distance between the face of the glass plate and the plane of the image.

For instance, readings of 9·6 mm. on the engraved cross and 8·3 mm. on the image indicate that the image is 1·3 mm. in front of the plate, or in other words, that the plate carriage has to be moved 1·3 mm. forward in order to be in exact focus. Readings of 9·6 mm. on the engraved cross and 12·6 mm. on the image indicate that the image is 3 mm. behind the face of the glass and that the plate carriage must be moved 3 mm. backward.

9. Definitions.

The *axis of the camera* is a line through the optical centre of the lens parallel to the direction of motion, that is to say parallel to the rails. It must coincide with the optical axis of the lens; the flange of the latter must be so affixed to the camera that this condition is approximately fulfilled, otherwise the definition is impaired away from the centre of the plate.

The *centre of the board* is the point where the axis of the camera strikes the face of the board; it may be some distance from the geometrical centre.

The *centre of the plate* is the point where the axis of the camera strikes the face of the plate.

The image of the centre of the board always falls upon the same point of the plate (the centre of the plate). These two points are the only ones endowed with this reciprocal relation.

The *reduction, n,* is the proportion of the lines of the original to the corresponding lines of the image.

The *enlargement,* also designated by n, is the proportion of the lines of the image to the corresponding lines of the original.

According to these definitions, a reduction of 3·00 means that the linear dimensions of the original are three times the dimensions of the image. An enlargement of 3·00 means that the linear dimensions of the image are three times the dimensions of the original. Reductions and enlargements are never less than unity.

10. Geometry of the Copying Camera.

Relations between conjugate foci.—Let A, Fig. 8, be the lens in position for reducing, u and v being the distances to the board and to the plate respectively. The reduction is:

$$n = \frac{v}{u}$$

The values of u and v are:—

$$u = (1 + n) f \qquad (1)$$

$$v = \left(1 + \frac{1}{n}\right) f \qquad (2)$$

f being the focal length of the lens.



FIG. 8.

Moving the lens to B for enlarging, the relations become:—

$$n' = \frac{u'}{v'}$$

$$u' = \left(1 + \frac{1}{n}\right) f \qquad (3)$$

$$v' = (1 + n) f \qquad (4)$$

The various distances are accordingly as follows:—

	For reducing.	For enlarging
Board to Lens	$(1 + n) f$	$\left(1 + \frac{1}{n}\right) f$
Lens to Plate	$\left(1 + \frac{1}{n}\right) f$	$(1 + n) f$
Board to Plate*	$\left(2 + n + \frac{1}{n}\right) f$ (5)	

* 'Board to Lens' is in reality the distance to the first nodal point; 'Lens to Plate' is from the second nodal point. For 'Board to Plate', it would be necessary to add the distance between the nodal points, but this distance being eliminated in the application of these values made here, reference to the nodal points has, for the sake of simplicity, been omitted.

Differential motions.—If, the lens being at *A*, Fig. 9, for reducing the board is

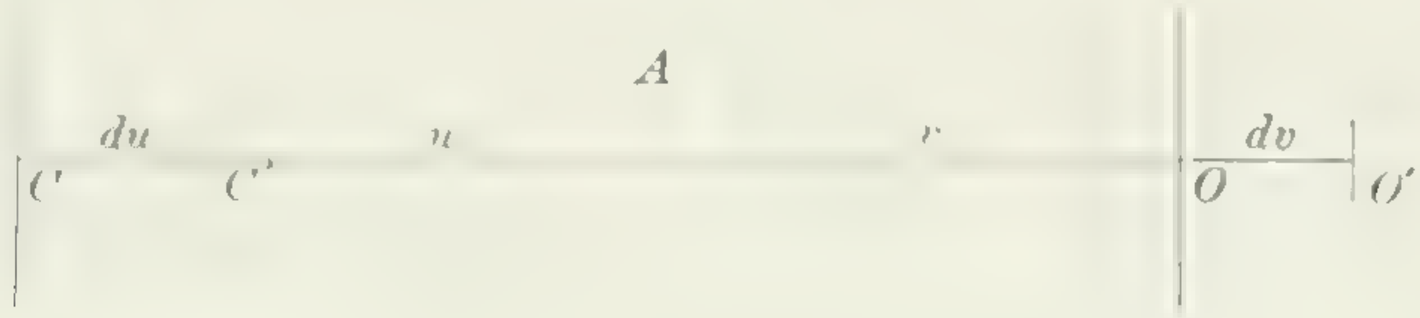


Fig. 9

slightly displaced from *C* to *C'*, the image which at first formed in *O* will now be in O'. The relation between the displacement of the board, *du*, and of the plate, *dv*, obtained by differentiating (1) and (2), is:—

$$du = \frac{}{} dv \qquad (6)$$

For an enlargement the relation is inverted:—

$$du' = -\frac{dv'}{n} \qquad (7)$$

Thus for a reduction of 3·00, the displacement of the plate is one-ninth of the displacement of the board, while for an enlargement of 3·00, the displacement of the plate is nine times the displacement of the board.

Changes of scale.—When a map on a scale of *a* miles to one inch is reduced *n*, the scale of the copy is *na* miles to one inch. To reduce a map on a scale of *a* miles to one inch to *b* miles to one inch, the reduction must be $\frac{b}{a}$. Likewise, when a map on a decimal scale $\frac{1}{a}$ is reduced *n*, the scale of the copy is $\frac{1}{na}$. To reduce a map on a decimal scale $\frac{1}{a}$ to the scale $\frac{1}{b}$, the reduction must be $\frac{b}{a}$.

An enlargement *n* of a map on a scale of *a* miles to one inch produces a copy on a scale of $\frac{a}{n}$ miles to one inch. To enlarge the map from the scale of *a* miles to one inch to the scale of *b* miles to one inch, the enlargement must be $\frac{a}{b}$.

Likewise, when a map on a decimal scale $\frac{1}{a}$ is enlarged *n*, the copy is on the scale $\frac{n}{a}$. To enlarge the map from the scale $\frac{1}{a}$ to the scale $\frac{1}{b}$, the enlargement must be $\frac{a}{b}$.

When a map on a scale of *a* miles to one inch is reduced *n'* and the copy is subsequently enlarged *n''*, the final scale is $\frac{n'a}{n''}$ miles to one inch. A map on a scale of *a* miles to one inch will be changed to a scale of *b* miles to one inch by reducing it *n'* and enlarging the copy *n''* provided:

$$\frac{n'}{n} = \frac{b}{a}$$

When the copy desired is larger than the plate it is proposed to work with, the change of scale may be made in two different ways. A number of negatives sufficient to cover the whole map can be made on the desired scale; these are printed by contact and the prints are joined together to form the copy. The other way is to make a reduced negative of the whole map, to put the negative in the enlarging camera and to enlarge it to the requisite scale on a single piece of bromide paper. The first method gives a sharper result; the second method saves work and has the advantage of producing a copy on a single sheet of paper.

As an illustration, suppose a map 42″ × 54″ on a scale of 10 miles to one inch has to be reduced to 12 miles to one inch and the plate it is proposed to employ is 10″ × 12″. The reduction is:

$$n = \frac{12}{10} = 1{\cdot}20$$

The reduced map will be 35″ × 45″. Setting the copying camera at a reduction of 1·20, it takes fifteen or sixteen negatives 10″ × 12″ to cover the map. The negatives are printed by contact and the fifteen or sixteen pieces are joined together to make the finished copy.

Sharpness of the lines may not be essential, or it may be desired to save work or to have the finished copy in one piece. Should this be the case, one negative of the whole map is made to be enlarged subsequently. The ratio of the short sides of the map and plate is $\frac{42}{10}$ or 4·20, the ratio of the long sides $\frac{54}{12}$ or 4·50; therefore the reduction n' must be at least 4·50 for covering the whole map with one negative. Make the negative with $n' = 5{\cdot}00$ so as to leave a little margin on the plate. An enlargement n'' has now to be made from this negative. The relation quoted above between n', n'' and the scales gives:

$$n = n' \times \frac{a}{b}$$

In this case:

$$n = 5.00 \times \frac{10}{12} = 4{\cdot}167$$

Therefore the map has first to be reduced 5·00 and then enlarged 4·167.

11. Adjustments of the Camera.

A good anastigmat, if used at a moderate angle, gives an image practically free from distortion, provided the board and plate are parallel and the optical axis of the lens is perpendicular to both. The last condition is sufficiently well fulfilled in a camera carefully constructed but it will not be amiss to check it. The first condition must be accurately fulfilled, means of adjustment being provided for that purpose.

Before proceeding with the adjustment, it is necessary to check, and to correct if needed, some of the details of construction.

The rails must be perfectly straight and parallel. This is checked by stretching a thread from one end of each rail to the other end, first with the cradle lying flat

down and next with the cradle lying on its side. Parallelism is checked by measuring the spacing of the rails.

The board must be perfectly flat. This is checked with a steel straight edge applied on edge against the face of the board at different places and in different directions. The board is straightened by means of the screws at the back until perfectly straight in all directions.

The plates in all the plate holders must register alike. For checking this, the largest holder with the selected glass plate is attached to the camera and the bellows are removed. Two wooden rods with straight edges are clamped to the frame of the plate carriage in front of the plate holder, one of the rods being opposite the top of the plate, the other rod opposite the bottom. Each rod is adjusted so as to be parallel to the plate, the space between the plate and the edge of the rods being carefully measured. Another plate-holder with a selected glass plate is now substituted, and the space between the edge of the rods and the four corners of the plate measured. The plate-holder or its fittings must be altered until this space is exactly the same as for the large plate-holder. The other plate-holders are successively fitted in accurate register by the same process.

12. The Centre of the Board.

The first adjustment of the camera is to find the centre of the board.

Shift the plate carriage to the end of the cradle as far as it will go, attach the plate-holder after inserting the engraved glass plate and removing the curtain and back. Pin to the board, approximately in the centre, the millimetre scale shown in Fig. 10. The lens carriage is now shifted and brought by means of the focussing

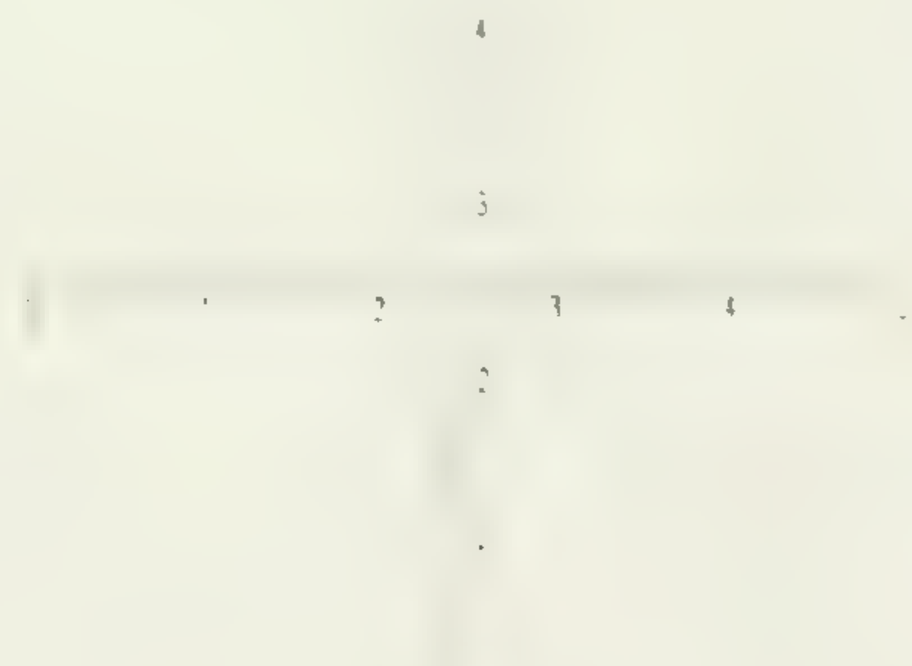


Fig. 10. Millimetre scale.

microscope to focus the image of the millimetre scale upon the face of the plate. This image will fall upon the cross engraved on the plate if the points selected as centres of the board and plate are not too far out. The vertical line of the plate will lie across the horizontal arm of the scale, and the horizontal line of the plate will lie

across the vertical arm of the scale. The readings of the scale at the two crossings are noted.

The lens carriage is then shifted towards the board till the image is in focus again, and the readings of the scale are noted as before.



FIG. 11.

Let Fig. 11 represent a vertical section through the axis OC of the camera, EF being the board, OP the plate, A and B the first and second positions of the lens, P the horizontal line of the engraved cross, N and M the two divisions of the millimetre scale whose image falls upon P, and a and b the corresponding readings of the scale.

It will be noted that in this case $u = v'$ and $v = u'$; that is to say, the reduction and enlargement are equal:

$$n = \frac{u}{v} = \frac{v'}{u}$$

In reducing, PO is the image of MC; hence:

$$PO = \frac{MC}{n}$$

In enlarging, PO is the image of NC; hence:

$$PO = n \times NC$$

Combining the two equations:

$$n^2 \times NC = MC$$

and:

$$NC = \frac{MN}{n^2 - 1}$$

But:

$$MN = b - a$$

and:

$$NC = \frac{b - a}{n^2 - 1}$$

The reading of the scale where it is intersected by the horizontal line passing through the centre of the board is accordingly:

$$b + \frac{b - a}{n^2 - 1}$$

Through this division of the scale, a horizontal line is drawn on the board.

The same procedure is followed for the horizontal branch of the millimetre scale and a vertical drawn through the proper division of the scale. The intersection of the horizontal and vertical lines so drawn is the centre of the board.

Through the centre of the board two lines at right angles, approximately horizontal and vertical, are drawn right across the board. Their images must be as nearly as possible parallel to the sides of the plate.

The extension of the reverse camera being comparatively short, the limit of n for enlarging is small. With small values of n, the term $\frac{b-a}{n^2-1}$ in the expression for the reading of the scale becomes inaccurate. Instead of setting the reverse camera at equal reduction and enlargement, it is preferable to set it first at the greatest reduction, n, and then at the greatest enlargement, n', the extension admits of. Keeping the same notation as before, it is easily found that the reading of the scale for the centre of the board is:

$$b + \frac{b - a}{nn' - 1}$$

13. The Centre of the Plate.

The centre of the plate is the point upon which falls the image of the centre of the board. If the camera has been accurately constructed, this point is very close to the cross engraved on the plate. For convenience in registering lithographic transfers, it is necessary that the optical and geometrical centres of the plate should nearly coincide; the discrepancy, if any, must be removed by altering the plate-holder or its fittings. For the same reason, the images of the two lines drawn across the board must be parallel to the sides of the plate; care is taken to fulfil this condition in drawing the lines.

14. Adjustment of the Board and Plate-holder Frame.

The board and plate must both be accurately perpendicular to the axis of the camera.

The adjustment is effected by means of the optical square shown in Fig. 12. It consists of a telescope attached to two brass plates between which wooden arms are bolted. At the end of each arm is a small adjusting screw. The diaphragm of the telescope bears two threads at right angles, one of them being parallel to the wooden arms. Several pairs of wooden arms of different lengths are provided; the pair used for the board has the adjusting screws at the back instead of in front. The normal plane of the optical square is indicated by lines drawn on the two brass plates and by notches on the cell of the objective.

For adjusting the optical square, the plate carriage is moved to the extreme end of the cradle, the lens and front board are removed from the lens carriage and the millimetre scale shown in Fig. 10 is pinned to the centre of the board.



FIG. 12 Optical Square.

Let AB, Fig. 13, be the plate, DE the board, O the centre of the plate, C the centre of the board. Having focussed the telescope, apply the optical square against the plate, arms horizontal, screws G and H resting against the glass and the notch of the objective cell on the vertical line O of the central engraved cross. The line is too fine to be seen with the naked eye and must be indicated by a small piece of

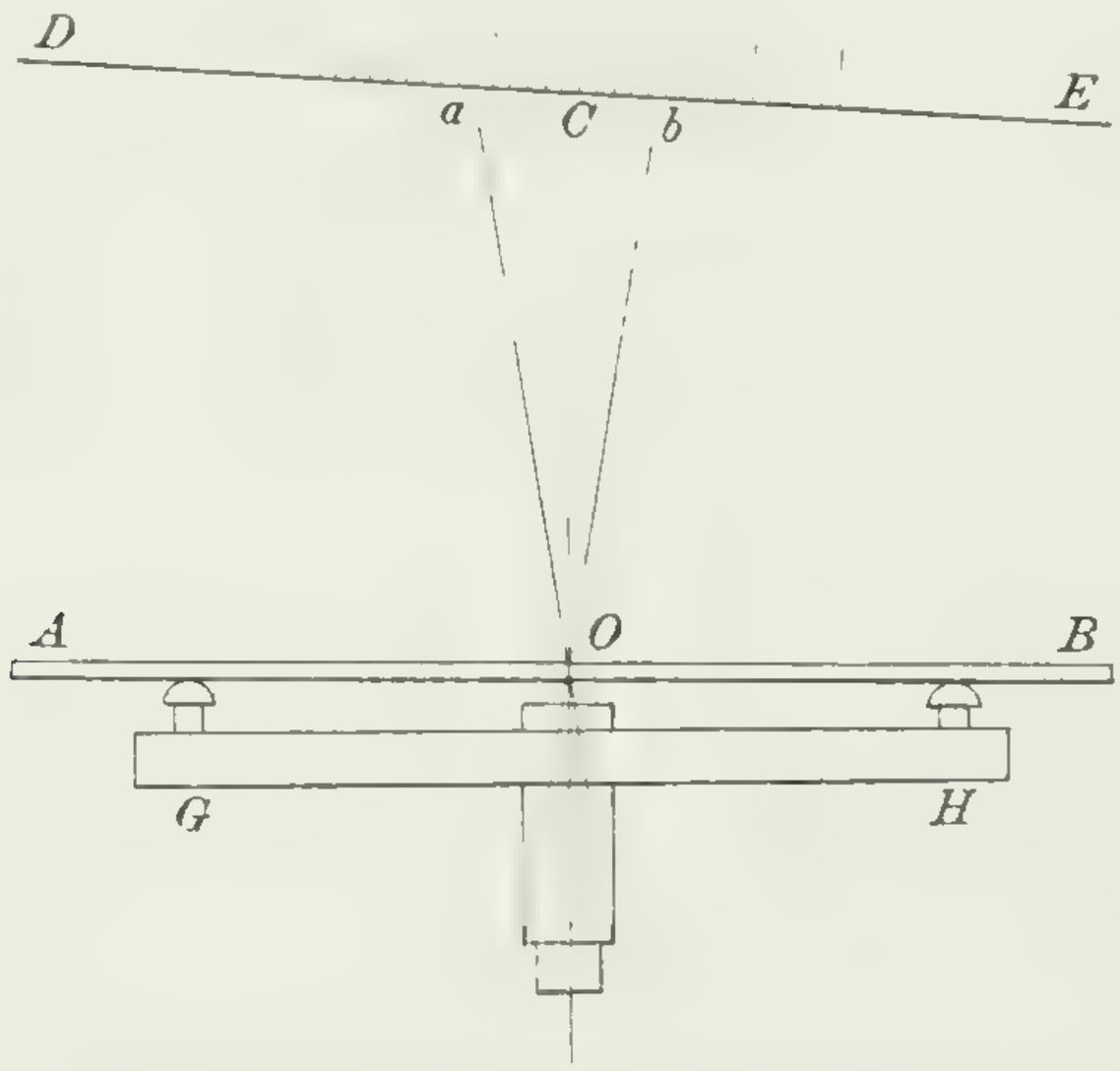


FIG. 13 Adjustment of the Optical Square

paper pasted to the glass. Looking through the telescope, the vertical thread is seen to cross the horizontal arm of the scale and the reading, a, is noted. The optical square is now reversed end for end. If the same reading, a, of the scale is obtained, the optical square is in adjustment. If not, the second reading, b, is noted, and one

of the screws G or H at the end of the wooden arms is screwed or unscrewed until the reading on the scale becomes:

$$\frac{a+b}{2}$$

The adjustment of the plate-holder frame is now proceeded with. Applying the optical square against the plate AB, Fig. 14, arms horizontal, in the same position as before, the screws S and T, which command the slides of the trunnions, are turned in opposite directions till the vertical thread of the telescope is seen to pass through the centre C of the board.

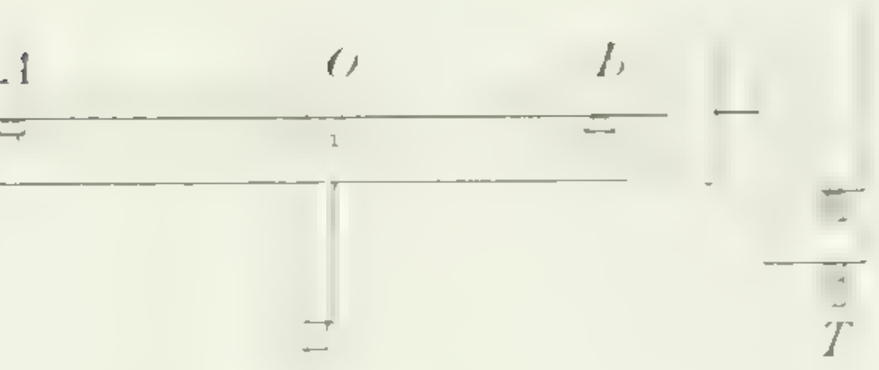


FIG. 14.—Adjustment of the Plate-holder Frame.

The optical square is next fixed against the plate, wooden arms vertical, the notch of the objective cell being held on the horizontal line of the engraved cross.

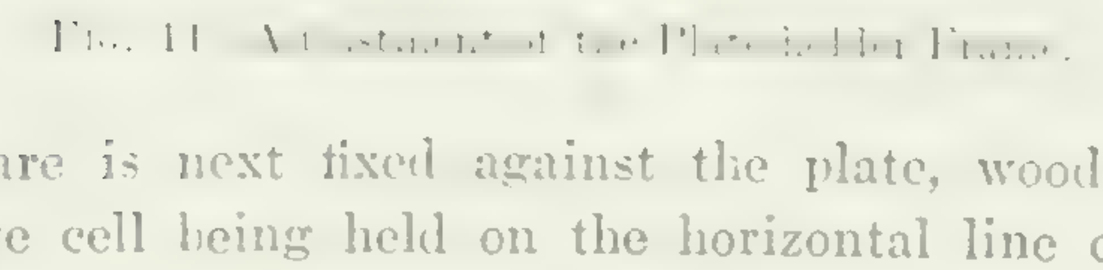


FIG. 15.—Adjustment of the Board.

The bottom slide is screwed in or out until the horizontal thread of the telescope is seen to pass through the centre of the board.

The board is adjusted by the same method. The millimetre scale is stuck to the centre of the plate at *O*, Fig. 15, the plug in the centre of the board, *C*, is removed and the telescope of the optical square is inserted through the opening, arms horizontal, the line of the normal plane drawn on the instrument being brought in coincidence with the vertical line of the board. The optical square is adjusted in the manner already described by screwing in or out one of the screws, *G* or *H*. With the arms of the optical square horizontal, the board is revolved by turning in opposite directions its adjusting screws on the right and on the left until the vertical thread of the telescope is on the centre of the plate. With arms vertical, the board is revolved by turning in opposite directions its top and bottom adjusting screws, until the horizontal thread of the telescope is on the centre of the plate. Care must be taken to turn the screws evenly, otherwise the face of the board would be bent.

15. Graduations.

There is a double graduation for each lens, one side being for setting the lens carriage, and the other side for the plate carriage.

The graduation is calculated as follows: Let *DE*, Fig. 16, be the board, *FG* the plate at the far end of the cradle, *CO* the axis of the camera, *A* and *B* the two positions of the lens for which the image is in focus on the plate, *CB* being equal to *AO*. The focal length found by subtracting (2) from (1) is:



Fig. 16.

AB is the displacement of the lens carriage. It is measured on the rod attached under the cradle, the two positions being marked upon it. For focussing, the microscope is set on the plate at *O*, the tube is turned until the cross lines engraved on the plate are in focus and the reading of the microscope scale is noted. By repeating the operation several times the focus is accurately ascertained. Replacing the microscope on the plate, the tube is turned till the image of the board is perfectly sharp and distinct and the reading of the microscope scale is noted. This also is repeated several times. The difference of the two readings is approximately the distance the lens carriage has to be moved to bring the image of the board on the face of the plate. After moving the lens carriage, the focussing is repeated until an exact focus is obtained.

The reduction, n, is found by measuring DE and FG.

Through the centre of the plate, O, Fig. 17, draw a parallel MN to the long sides of the plate; at equal distances from the centre and near the edge, erect perpendiculars in M and N. The crosses at the two ends of this line must be drawn with a diamond on the plate. In drawing these lines as well as the cross at the centre, the diamond must be held at the proper angle and a very light pressure exerted, hardly more than the weight of the diamond, otherwise the lines will be ragged and accurate measurements impossible. Rubbing a pencil across the lines helps to make them visible.

Upon the board, two points, A and B, are marked on the horizontal line at equal distances from the centre, C, and such that their images will fall very nearly upon the points M and N of the plate. At these points erect perpendiculars to the hori-

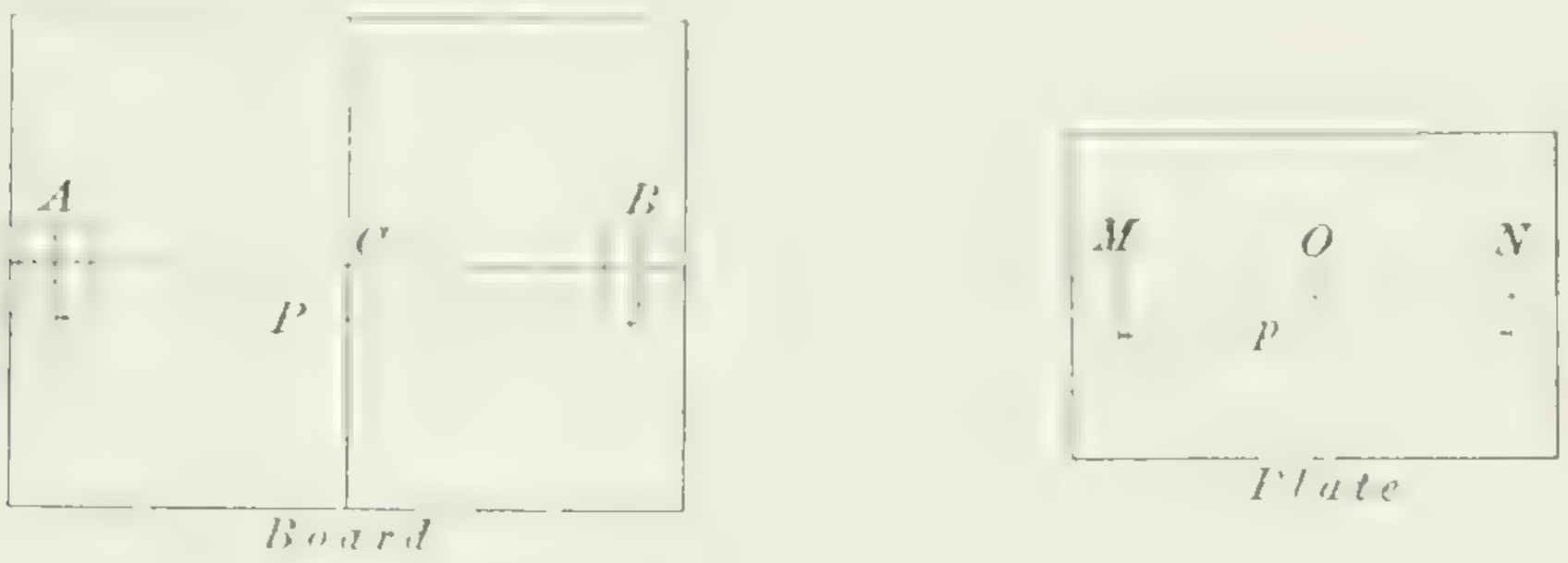


FIG. 17.

zontal line and upon the crosses so formed pin two of the millimetre scales shown in Fig. 10. Measure carefully the distances p between M and N, and P between A and B. Looking now at the plate the vertical line N will be seen to cross the horizontal arm of the scale A, and the vertical at M the horizontal scale B. Let a and b be the readings of the two scales; then the reduction is:

$$n = \frac{P + b - a}{p}$$

This value of n used in (8) gives the focal length.

It is somewhat difficult to focus accurately an enlarged image; it is, therefore, preferable to determine the position of the lens carriage at B, Fig. 16, by focussing from the board side. This is done by inserting the microscope through the centre hole of the board and resting the base against the face of the board. The reading of the microscope scale for the face of the board is ascertained by focussing a scratch on the back of a glass plate and adding the thickness of the base of the microscope.

The graduation for the plate carriage is obtained by calculating the distance board to plate for the various degrees of reduction or enlargement; this distance, given by (5), is:

$$f\left(1 + n + \frac{1}{n}\right).$$

For the lens carriage, the distance board to lens for a reduction is given by (1) as:

$$f(1 + n)$$

For an enlargement, it is given by (3) as:

$$\left(1 + \frac{1}{n}\right) f$$

A table of the values of $2 + n + \frac{1}{n}$ and $1 + \frac{1}{n}$ is given in Part III; it is unnecessary to give a table of $1 + n$, as it would merely be one of consecutive numbers.

The numbers of these tables have to be multiplied by f; this is quickly done with an arithmometer.

For drawing the graduation on the rod, the two reference marks at A and B, Fig. 16, are used as starting-points. The divisions are marked for every 0·01 of n; they are located by dividing into equal parts the spaces between the values of the table. The figures for the lens carriage are made black and those for the plate carriage red.

Instead of the above graduations, a single scale of equal parts, a millimetre scale for instance, might be attached to the rod and the setting of the carriages done by means of the calculated tables. This would save drawing the graduation, the setting would be somewhat more accurate and it would have other advantages.

16. Readjusting the Focus.

The board, the plate holder frame, the graduation or the pointers may, for some reason or other, become displaced. Should this happen, the image of the board will no longer form on the face of the plate when the lens and plate carriage are set on corresponding divisions of the graduation. In order to ascertain how much the board and plate-holder frame have to be moved to bring them back to correct position, the camera is set for a reduction of n, the lens carriage being at A, Fig. 18, the plate at O and the board at C. Let F be the position of the image of the board: with



Fig. 18

the focussing microscope measure the interval $OF = a$ between the plate and the image. Next move the lens carriage to B for an enlargement of n, and with the focussing microscope measure the interval $CE = b$ between the board and the image E of the plate. Let D and G be the correct positions of the board and plate respectively, y and x being the changes required to bring them to their correct places. In other words, if the board be moved from C to D, its image will move from F to G; and if the plate be moved from O to G, its image will move froom E to D. But the relation between these displacements is given by (6). It is:

$$CD = n^2 \times FG$$
$$OG = n^2 \times DE$$

or:

$$y = n^2 (a - x)$$
$$x = n^2 (b - y)$$

The values of y and x derived from these equations are:

The tests are made for several values of n, the mean y and x being applied as corrections with the adjusting screws of the board and plate-holder frame. The correction can also be made by changing the position of the pointers, the lens carriage pointer being moved over an interval equal to y and the plate carriage pointer $x + y$.

It will be observed that the formula breaks down for $n = 1$, when the lens is midway between the plate and the board. The reason is because the lens, when near that position, can be moved forward or backward a small distance without changing the focus. It follows that the tests are best made with high values of n.

The factor

$$\frac{1}{1 - \frac{1}{n^2}}$$

is given below for different values of n up to 3·00. Above 3·00 the factor is unity.

n	$\frac{1}{1 - \frac{1}{n^2}}$	n	$\frac{1}{1 - \frac{1}{n^2}}$
1·20	1.93	1.80	1.10
1·30	1.54	1.90	1.08
1·40	1.35	2.00	1.07
1·50	1.25	2.25	1.04
1·60	1.18	2.50	1.03
1·70	1.14	3.00	1.01

Another method of readjusting a camera which has become disarranged is to focus it accurately and to measure the reduction as has already been explained. The pointers of the lens and plate carriages can then be moved to the divisions of the graduation representing the reduction found. This method is not as good as the other one.

17. Adjustment and Graduation of the Reverse Camera.

A new centre of the board has to be determined for the reverse camera; it may not be the same as for the direct camera. The determination is made in the manner already described for the direct camera.

The board being normal to the axis of the camera, requires no further adjustment. What remains to be done is to adjust the plate holder, or rather the mirror,

to set and clamp at the right place the reverse camera pointer of the lens carriage and to draw the graduation on the bed of the reverse camera.

The axis of the camera is reflected at right angles, or thereabouts, by the mirror; the condition that there shall be no distortion of the image requires that the plate be accurately perpendicular to the reflected axis. Evidently the adjustment could be made with the optical square by swinging the frame to which the plate-holder is attached, precisely as was done with the direct camera. It is preferable, however, instead of moving the plate-holder frame, to swing the mirror until the reflected axis is normal to the plate. Preference is given to the adjustment of the mirror because, being put in and taken out frequently, its position is liable to be disturbed, and because its readjustment, once its correct position has been determined, is very simple and quickly made.

The reflected axis must also be parallel, approximately at least, to the direction of motion of the plate, otherwise the centre of the plate will cease to be invariable and will change with the reduction or enlargement. Should the discrepancy be so large as to become troublesome, the fittings of the plate holder would have to be altered so as to make the plate normal to the direction of motion.

The first adjustment of the mirror can be made as follows:—

Draw a square on the plate, leaving a margin of an inch or two on the four sides; mark the four corners with a diamond, draw a corresponding square on the board so that its image shall coincide as nearly as possible with the square drawn on the plate. Unless the mirror is in adjustment, the image is not a square; the adjustment is effected by turning the mirror till the opposite sides of the image become equal.

Let *A B C D*, Fig. 19, be the square drawn on the plate and *E F G H* the image. The distortion of the sides *E G* and *F H* can be measured by pinning continuous scales of equal parts to the board along *E G* and *F H* and counting the number of divisions intercepted on each scale between the lines *A B* and *C D* of the plate. The

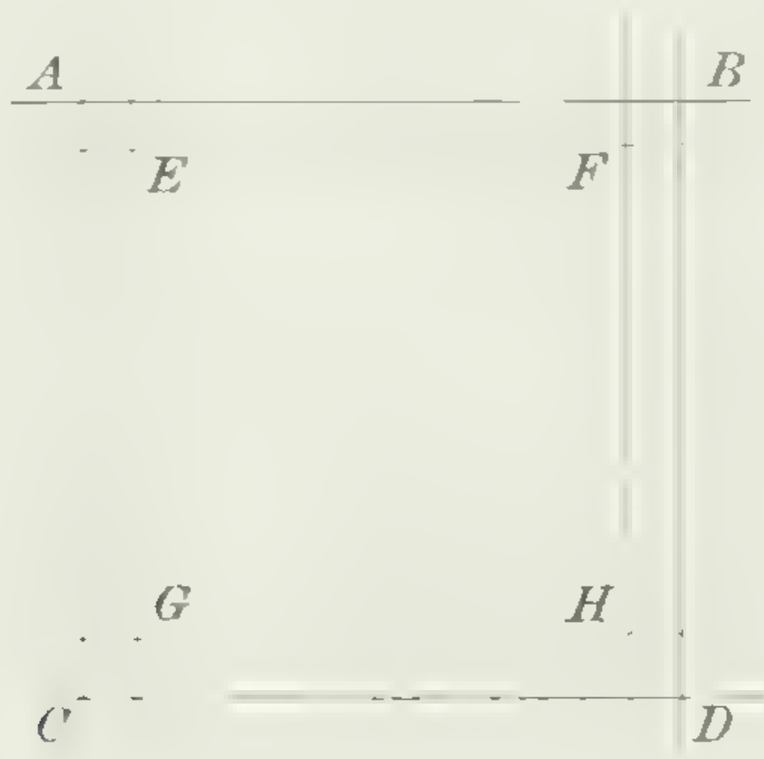


Fig. 19.

ends of the scales only being used, it is sufficient to measure on the board the length of the side of the square in millimetres and to pin at each of the four corners one of the millimetre scales shown in Fig. 10. The number of divisions that would be intercepted if the scales were continuous is readily figured out from the readings of the millimetre scales. The following is the rule for rotating the mirror:—

If the number of divisions intercepted is greater at the bottom of the plate than at the top, revolve the mirror around its horizontal axis so as to bring the top of the mirror nearer to the plate.

If the number of divisions intercepted is greater on the left of the plate than on the right, turn the mirror clockwise, looking from above, around its vertical axis.

The rule may be put in another form:—

Turn the mirror so as to decrease the distance between the side of the plate intercepting the smaller number of divisions and the corresponding side of the mirror.

After the mirror has once been adjusted, the centre of the plate, that is to say the image of the centre of the board, is marked on the framed glass plate. Whenever it is necessary to adjust the mirror again, for instance when it is changed, it is sufficient to turn it so as to bring into coincidence the image of the centre of the board and the mark for the centre of the plate, without resorting again to the process of adjustment described above.

The examination of the image near the corners of the plate is difficult, especially when the lens is working at a large angle, as it should be in order that the adjustment may be accurate. The difficulty may be overcome by making a negative and measuring the sides of the quadrilateral upon the negative.

Let Fig. 20 represent a horizontal section through the axis of the camera, DE being the board, AB the plate, G the image of the centre, C of the board, D and E



Fig. 20. Adjustment of the Mirror

the sides of the square on the board, A and B the sides of the quadrilateral image, W the angle subtended at the lens by half of the square, L the length in millimetres of the left side of the quadrilateral at A, and R the length of the right side at B. As represented by the figure, L is greater than R; to make them equal, the mirror must be turned so as to bring the image of the centre from G to O, the line MO being

perpendicular to the plane of the plate. If a millimetre scale is pinned at C, the number of divisions d of the image corresponding to GO is:

$$d = n(L - R)\left[\frac{(n+1)f}{P}\right]$$

in which P is the side of the square on the board in millimetres.* The lengths L and R are measured on the negative. The image of the centre must be displaced towards the smaller side of the quadrilateral image.

Likewise, the image of the centre is moved towards the top or bottom according as the top or bottom side of the quadrilateral is smaller, the displacement being calculated by the same formula. In both cases the displacement is readily ascertained by means of the cross lines engraved near the centre of the plate.

Incidentally, it may be observed that the image of a square original whose opposite sides have become unequal through the stretching of the paper can be restored to correct proportions by the adjustment of the mirror calculated by the above formula, the lengths L and R being equal to the corresponding lengths of the original divided by n. The formula for rectangular originals could, if required, be easily calculated. Distortion can also be corrected by a like process in the direct camera. The need of such corrections has, however, not been felt here.

For graduating, the camera is set for a reduction such that the width of the board covers the full width of the plate; the reduction is measured by the process described for the direct camera. Having ascertained this reduction, the lens carriage pointer of the reverse camera is moved to the proper division of the graduation and firmly clamped in position. A mark is made on the bed of the reverse camera opposite the pointer, and the graduation is drawn from this mark by means of the table of the values of

$$\left(1 + \frac{1}{n}\right)f$$

which has already been calculated for the direct camera.

* Representing the angle GMO by w, the figure gives:

$$MA \times \cos(W + w) = MO$$

$$L = 2\,MA \times \sin W$$

Multiplying by $\cos(W + w)$:

$$L \cos(W + w) = 2\,MO \times \sin W$$

The angle w being small, its cosine can be taken as unity:

$$L \cos W = 2\,MO \times \sin W + L \sin W \sin w$$

The right hand side of the figure gives in the same manner:

$$R \cos W = 2\,MO \times \sin W - R \sin W \sin w$$

Subtracting the last equation from the preceding one, and reducing:

$$\sin w = \frac{n(L - R)}{2P \tan W}$$

$$GO \times \sin w \times MO = n(L - R)\frac{\left(1 + \frac{1}{n}\right)f}{2P \tan W}$$

But d, the number of divisions of the image of the millimetre scale corresponding to GO, is $GO \times n$, and

$$\tan W = \frac{P}{2(1+n)f}$$

Substituting these values:

$$d = n(L - R)\left[\frac{(1+n)f}{P}\right]$$

It has been assumed at the start that the mirror was at the right place on the axis of the camera. This condition may not be accurately fulfilled.

Let Fig. 20*a* represent a section through the axis CP of the camera and the geometrical centre, O, of the glass plate marked by an engraved cross. The camera being set for an enlargement n', the mirror M is turned so as to reflect the image of the optical centre of the board, C, upon the geometrical centre of the plate O. Moving the lens carriage to NQ for a reduction n, it will usually be found that the point of

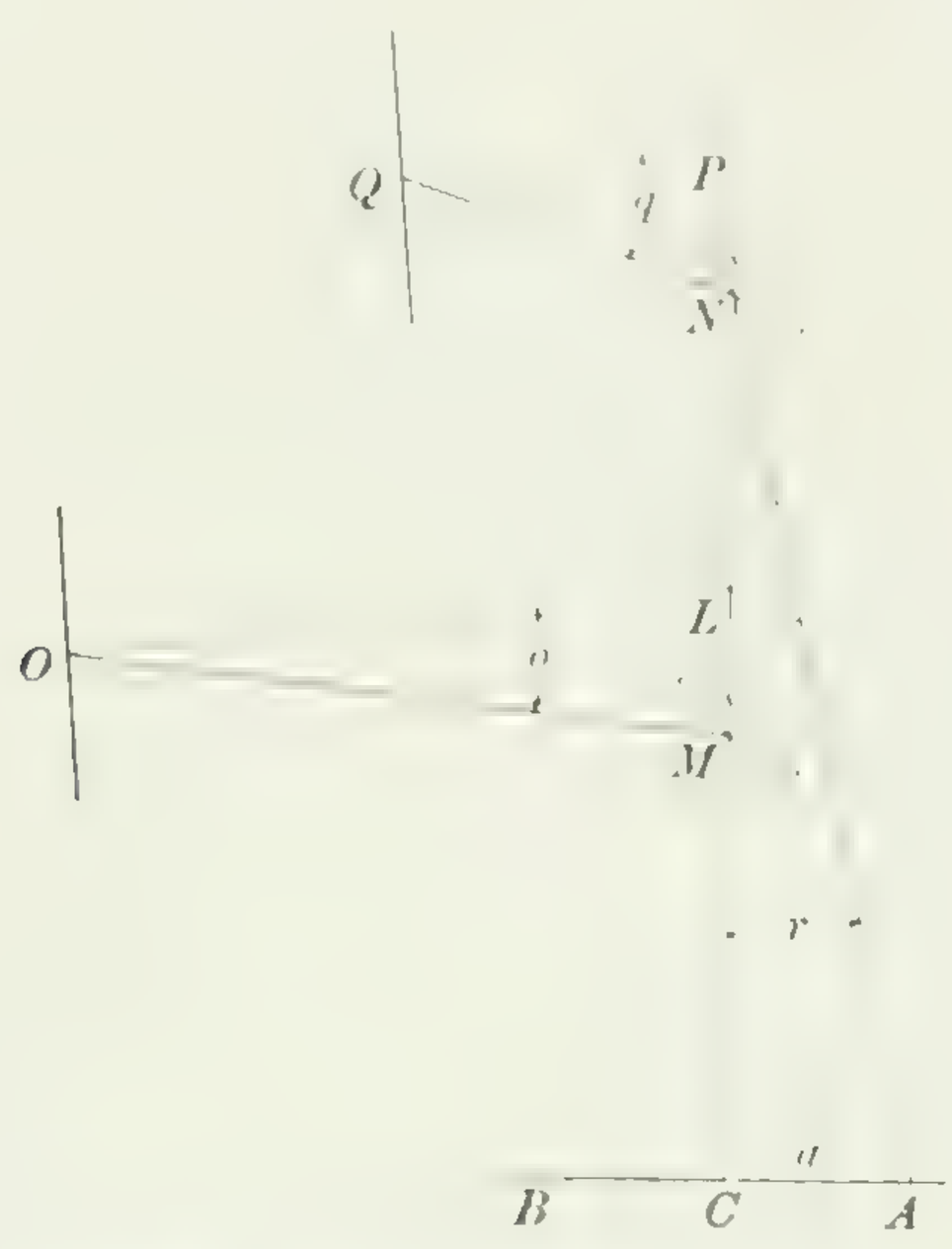


FIG. 20*a*.—Position of Mirror on the Axis.

the board whose image is reflected upon the central cross of the plate is no longer the centre of the board C, but a point A, a millimetres away from the centre. In order that the image of the centre C may always coincide with the central cross of the plate, the mirror must be moved from M to L, OL being the line followed by the central cross O when the plate is racked backwards and forwards. The perpendicular distance, b, between the two positions M and L of the mirror is:—

$$b = \frac{a}{\sqrt{2}} \cdot \frac{1+n}{n}$$

a is read on the millimetre scale glued to the plug in the centre of the board.

* Let QP be the direction of translation of the plate parallel to OL, PN being equal to LM. Designate the angles LOM, PQN and CNA by o, q, and r respectively. The angles being small, their values are approximately:—

$$o = \frac{LM}{OM}$$

$$q = \frac{PN}{QN} = \frac{LM}{QN}$$

$$r = q - o = \frac{LM}{QN} - \frac{LM}{OM}$$

But:

$$a = r \times CN$$

and:

$$a = CN \cdot LM \left(\frac{1}{QN} - \frac{1}{OM} \right)$$

In the latest pattern of this copying camera, provision is made for this adjustment. Fig. 20*b* is a section of the mirror box. The mirror slides into the groove *AB*, being pressed forward at the bottom by the brass springs *A* and *B*, and at the top by a spring in the centre, so as to be held by three points only and so to be free from strains. Opposite the point where the optical axis strikes the mirror is a screw *C* screwing through a brass plate *HG* fastened to the mirror box. The rounded head of the screw bears against a brass plate *LK* fastened to the mirror slide. When it is

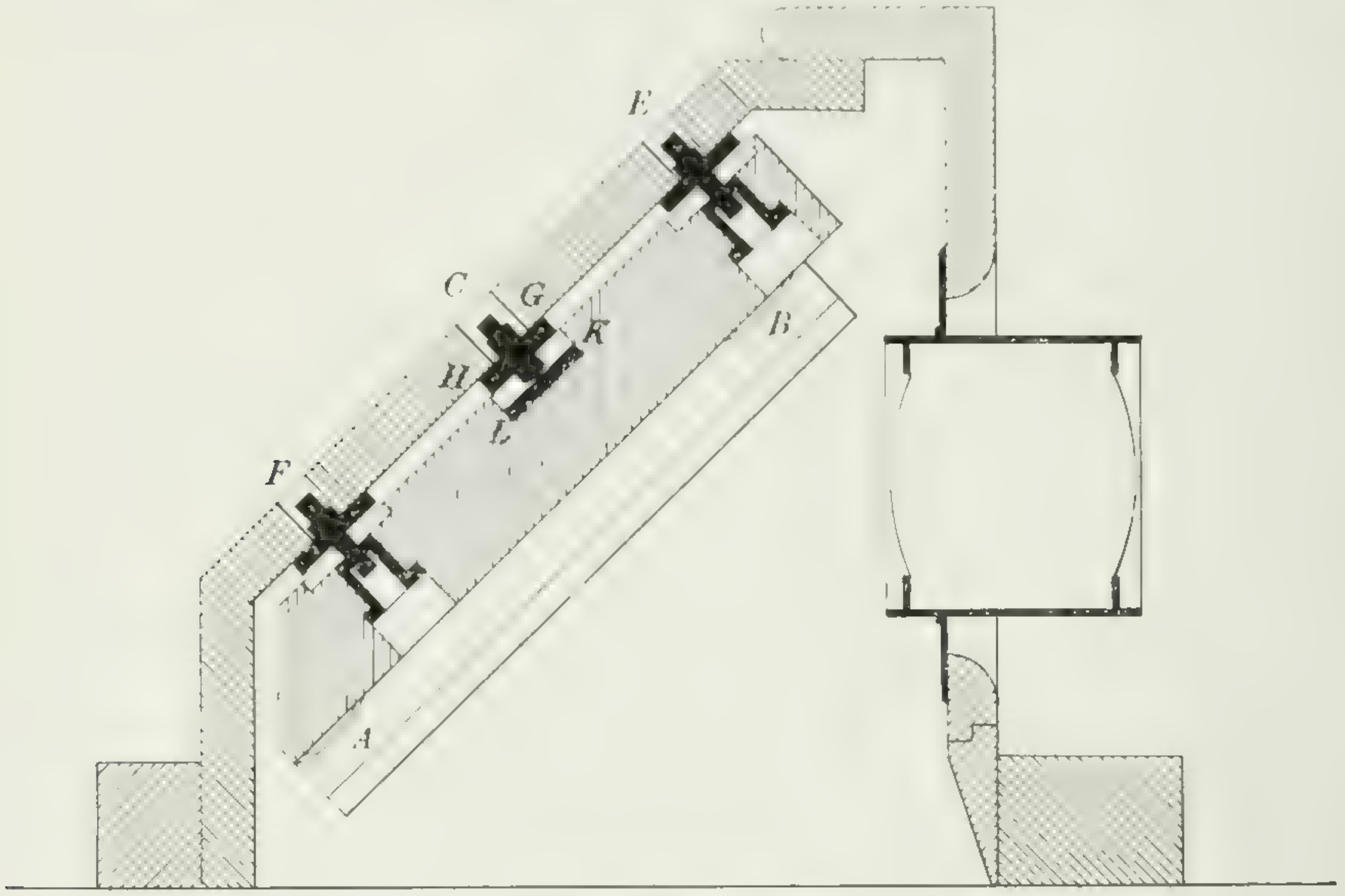


FIG. 20b. Mirror Box.

desired to move the mirror slide forward, the screws *E* and *F* and the two other adjusting screws must first be loosened and then the screw *C* is turned to the right. If the slide has to be moved in the opposite direction, the screw *C* is turned to the left and the four adjusting screws are screwed in so as to bring the mirror slide and plate *LK* in contact with the top of the screw *C*. The number of turns and fraction of a turn necessary for the displacement *b* of the mirror is calculated from the known value of the screw thread.

The board has previously been made perpendicular to the axis when making the adjustments of the direct camera. For finding the centre of the board for the reverse camera, the lens carriage is brought as close to the board as it will go and a set square applied against the board and opposite sides of the lens tube. The point so ascertained is quite accurate enough for practical purposes.

The values of CN, QN and OM, derived from (1), (2) and (4), are:

$$CN = (1+n)f$$

$$QN = \left(1 - \frac{1}{n}\right)f$$

$$OM = (1+n')f$$

Substituting these values in the preceding equation and reducing:

$$LM = a\frac{1 + n'}{nn' - 1}$$

The mirror being inclined at 45° to the axis the perpendicular distance b between the two positions M and L is equal to LM divided by the square root of two, or:

$$b = \frac{a}{\sqrt{2}} \cdot \frac{1 + n'}{nn' - 1}$$

PART II.—THE ILLUMINATION OF THE BOARD.

18. Lights and Reflexions.

Electric light is so much more convenient than daylight for copying that there can be no hesitation in selecting between the two. Two kinds of light are available, viz., the mercury tube and the arc lamp. The latter is in use here.

In disposing the lights, care must be taken to secure even illumination and to avoid reflexions. Photographs on glossy paper, varnished paintings, etc., are apt to cause trouble unless the lights are outside the range of reflexion. It is different with drawings: an original on glossy tracing linen may yield a perfect negative, while one on dull paper photographed under identical conditions may produce a negative in which the lines are more or less fogged. The explanation is that the reflexions which cause the trouble are from the surface of the ink lines, while those from the blank spaces are comparatively harmless. Ordinary Indian ink dries shiny. Several photo-drawing inks are in the market, but they are not in favour with draughtsmen.

The light from an alternating current lamp is fairly uniform in all directions within a wide angle; this is not the case with direct current lamps, and the remarks which follow do not apply to them. The intensity of an arc lamp fluctuates considerably: any conclusion that may be arrived at respecting the strength of the illumination produced must be taken as a rough approximation only. Fortunately moderate variations from the normal exposure do not affect the quality of the negative.

19. Light Intensities with One Lamp.

The brightness of a surface, BC, Fig. 21, at various distances from a source of

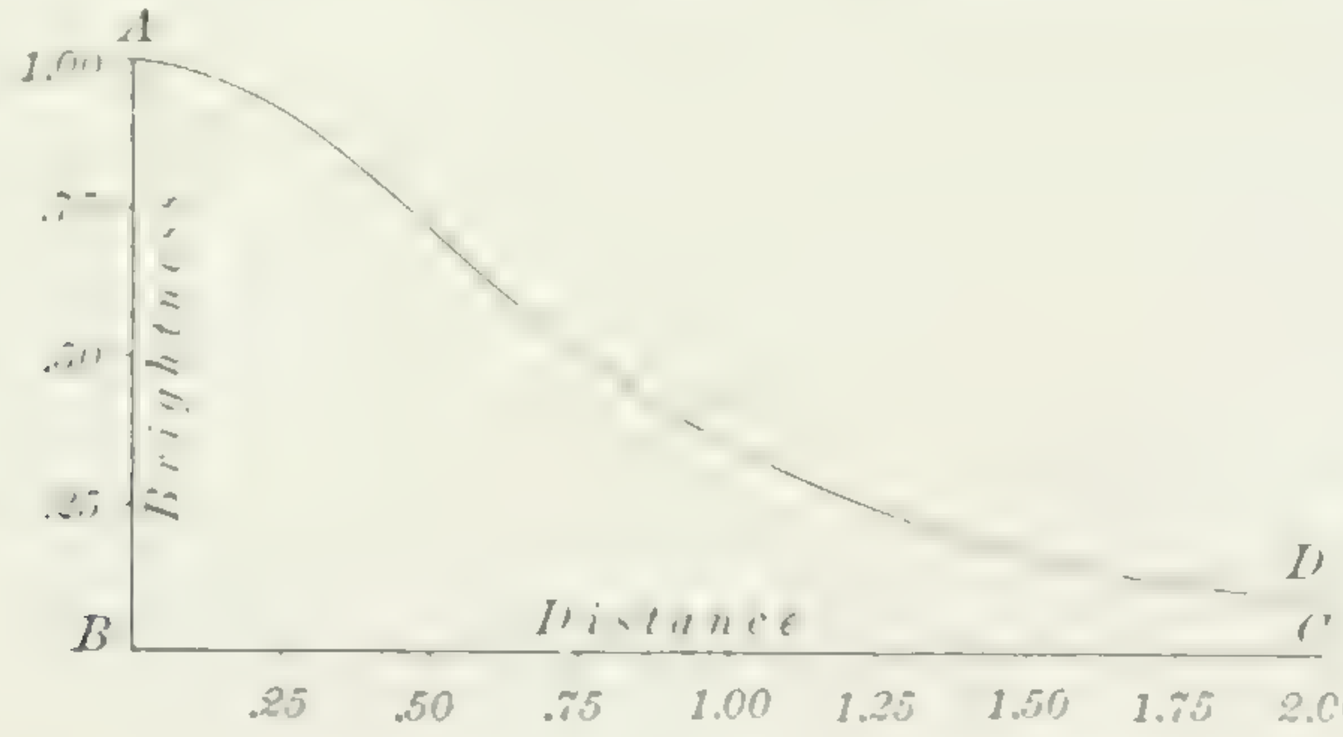


FIG. 21.—Illumination of a surface by a luminous point.

light, A, is represented by the curve AD. The curve shows that the brightness is tolerably uniform just opposite the light but falls off rapidly as the distance increases. It follows that unless the original to be copied is small, a single arc lamp has to be far away in order to give even illumination. Moreover, it has to be placed to one side for avoiding reflexions, and this is apt to show the grain of the paper.

20. Light Intensities with Two Lamps.

With two lamps, conditions are improved. Fig. 22 shows the brightness at several points of a square illuminated by two lamps opposite *A* and *B* at a distance from the square equal to half of its diagonal, the brightness of one lamp at that distance being taken as unit. The brightness is greatest just opposite the lamps and somewhat less in the centre, but it falls off rapidly away from the middle line, being only six-tenths of the greatest brightness at the top and bottom of the square. The best illumination is secured by placing the longest dimension of the original to be copied in the direction of the line of the lamps.

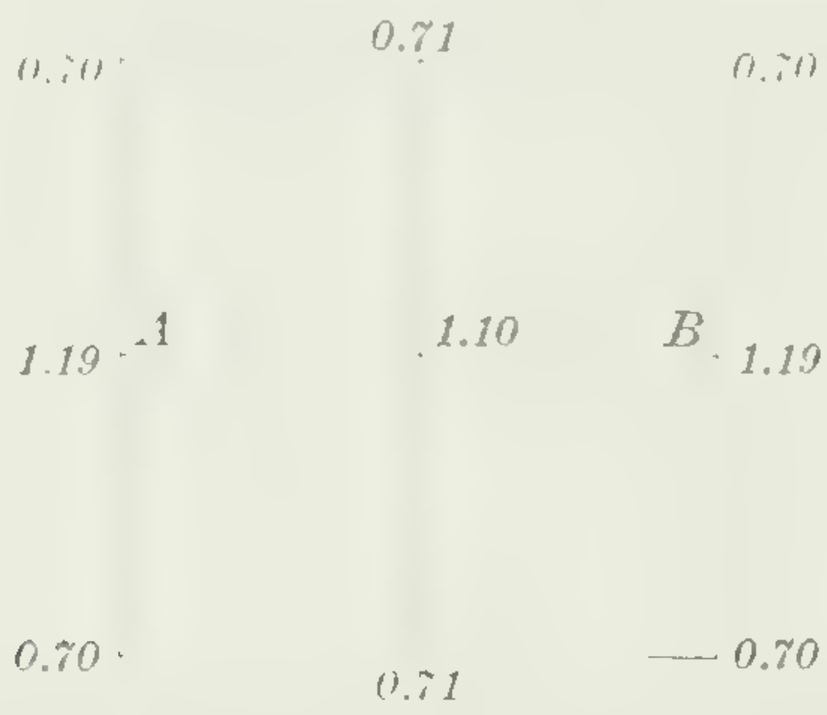


FIG. 22 Brightness of a square illuminated by two lamps

By increasing the distance of the lamps one-fifth, making it equal to $AB \times \cdot 85$, the uniformity of the illumination, shown in Fig. 23, is somewhat better; it is uniform along the middle line, and nearly seven-tenths of its greatest value at the top and bottom of the square. This illumination is sufficient to yield a good nega-

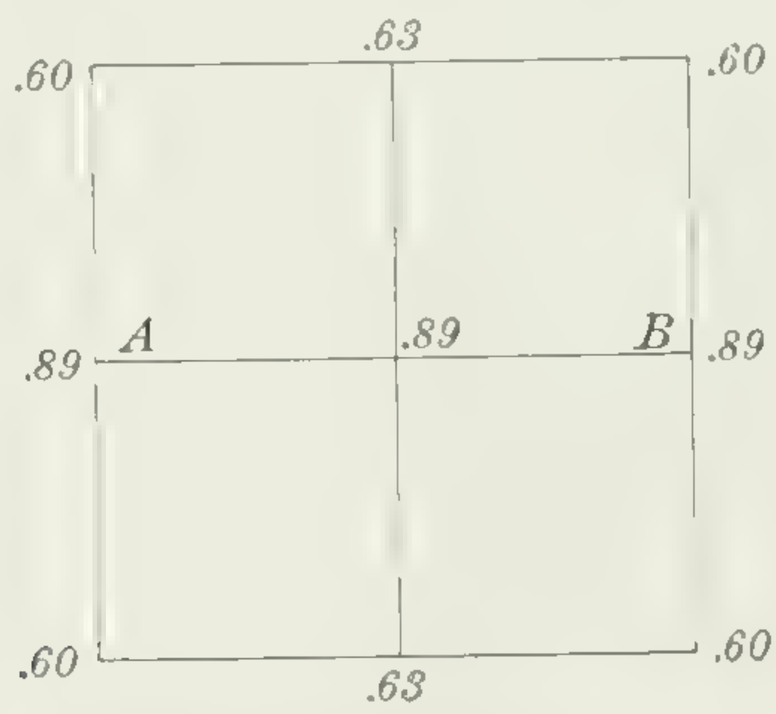


FIG. 23—Brightness of a square illuminated by two lamps.

tive of a line drawing. Still the operator might as well have all chances in his favour, and a better result is obtained with four lamps.

21. Light Intensities with Four Lamps.

The most even illumination in this case is secured by placing the lamps at equal distances from the board and from the axis of the camera.

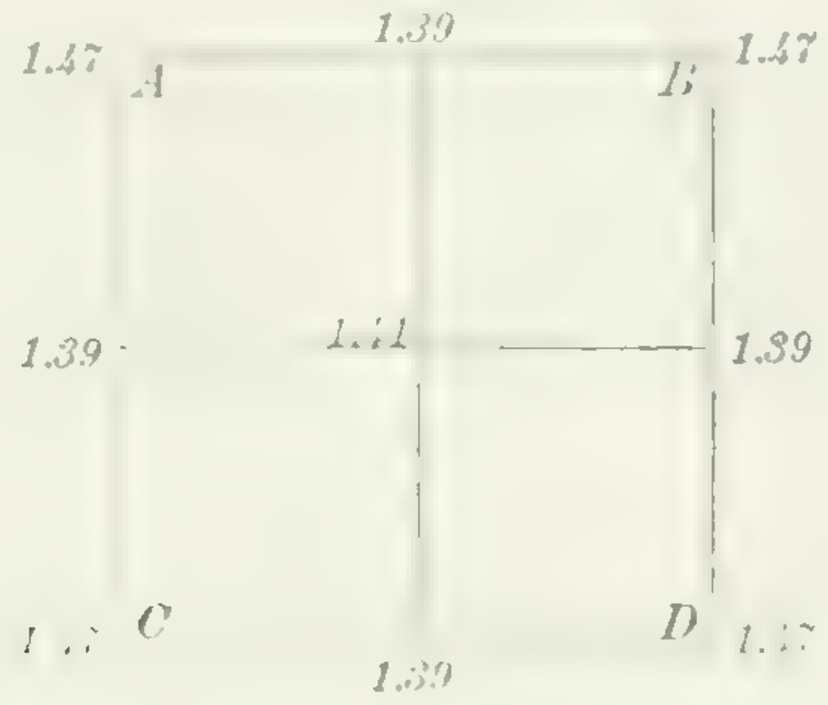


Fig. 24. Brightness of a square illuminated by four lamps.

Fig. 24 shows the brightness of a square illuminated by four lamps opposite the corners *A*, *B*, *C*, *D*, the distance from the board being equal to $\frac{1}{2} AB \sqrt{2}$. By placing the lamps a little closer to the board, the brightness is greater at the margin than in the centre, and this is as it should be for producing even illumination on the plate.

22. Reflexions and Focal Length of the Lens for Two Lamps.

The trouble from reflexions is not peculiar to artificial light; it arises in daylight from a bright background behind the camera or from light reflected by a polished camera front or by the lens mount. No good reason exists why the front of

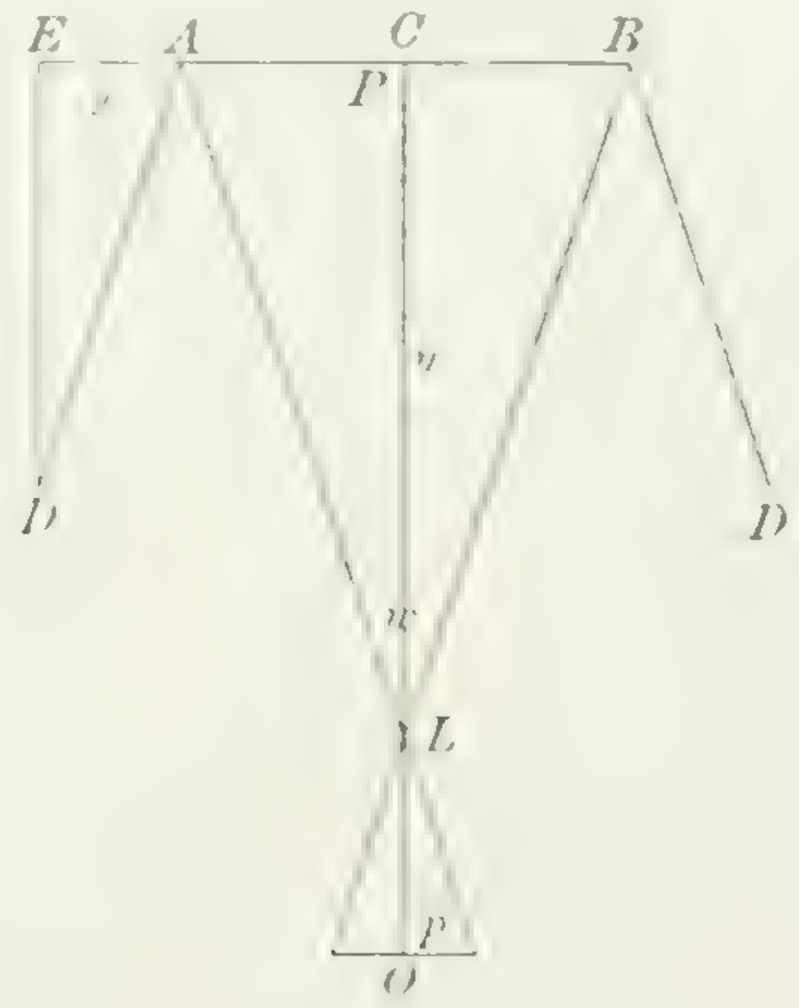


Fig. 25.

the camera should be polished; it is preferable to have it dull and dark. A lens protected by a deep hood, as it should always be, cannot reflect stray light. The space behind the camera should preferably be dark.

Arc lamps must be placed far enough from the axis of the camera to be beyond the range of reflexion, their distance depending upon the dimensions of the original to be copied and the focal length of the lens. Considering first the case of two lamps, let AB, Fig. 25, represent the original pinned to the board, OC the axis of the camera, L the lens, u the distance from the lens to the board, O the plate, P and p the widths of the original and plate. From A and B draw the lines AD and BD', making the same angle with the board as AL and BL. Reflexions are avoided if the lamps are kept outside of the lines AD and BD'. Let them be put in D and D'. From D let fall a perpendicular DE to the plane of the board, and denote AE by y. It has been shown that in order to produce tolerably uniform illumination, the distance DE from the lamps to the board must be about $\cdot 85 \times 2\ EC$, or:

$$DE = \cdot 85\ (2\ y + P)$$

Similar triangles give:

$$\frac{DE}{y} = \frac{u}{\frac{1}{2}\ P}$$

Combining the two equations:

$$\frac{2\ y + P}{P} = \frac{u}{P} \qquad (9)$$
$$\frac{}{} \cdot 85$$

$2\,y + P$ is the separation DD' of the two lamps. The numerical value of the ratio $\frac{2\ y\ +\ P}{P}$ for the various values of $\frac{u}{P}$ and the angle 2 W subtended at the lens by the width of the original, are given below:

$\frac{u}{P}$	$\frac{2y+P}{P}$	2 W
1	6.67	53°
2	1.74	28
2.55	1.50	22
3	1.40	19
4	1.27	14
5	1.20	11

These figures illustrate how important it is to work with a lens of long focus. For:

$$\frac{u}{P} = 1$$

that is to say when the distance from the lens to the board is equal to the width of the original, the separation of the lamps must be 6·67 times the width of the original and their distance from the board 5·67 times the width. This would be impracticable for originals of large dimensions. For convenience in working, the lamps should not be farther apart than one and a half times the width of the largest originals. The table shows that this requirement is fulfilled when the distance from the lens to the board is 2·55 times the width of the original, the angle subtended at the lens being 22°.

The limitation of the separation of the lamps to one and a half times the width of the original determines the minimum focal length of the lens. Noting that:

$$P = np$$

$$u = (n+1)f$$

and

$$n = \tfrac{1}{4}P$$

Equation (9) gives:

$$f = 2.5p\frac{n}{n-1}$$

This shows that the greater the reduction, the longer the focal length must be. For a reduction not exceeding 1·25:

$$f = 1.5P$$

This is very nearly the diagonal of a square plate. The rule sometimes given in text books that the focal length must be equal to the diagonal of the plate is therefore correct so long as the reduction is small. For a reduction of 3·00 the focal length would have to be

$$f = 1.3P$$

which is 1·34 times the diagonal.

The conclusion that the focal length required increases with the reduction must be qualified. It rests upon the assumption that the whole plate is covered by the image, but when the reduction reaches a certain limit, the image with originals of ordinary dimensions becomes too small to cover the plate and the rule ceases to apply.

Another conclusion from (9) is that the wider the original, the farther apart the lamps have to be. For a rectangular original, the best position for avoiding reflexions is accordingly across the line of the lamps, the longest dimension being vertical if the lamps are to the right and left of the camera. But it has been shown that the most uniform illumination is secured when the longest dimension is parallel to the line of the lamps; this is another argument against the use of only two lamps for large work.

23. Reflexions and Focal Length of the Lens for Four Lamps.

With a four lamps outfit, D and D', Fig. 25, may be taken to represent the projections of the lamps. It was found that for uniform illumination:

$$DE = \tfrac{1}{2}P_1\sqrt{2}$$

This and a consideration of the similar triangles in the figure give:

$$\frac{2y+P}{P} = \frac{u}{P}$$

$$\frac{u}{P} = \cdot\,\bar{7}$$

The numerical values of the ratio, $\frac{2y+P}{P}$, of the distance between two adjoining lamps to the width of the original, and of the angle $2W$ subtended at the lens, is given below for various values of $\frac{u}{P}$

$\frac{u}{P}$	$\frac{2y+P}{P}$	$2W$
1	3.42	53°
2	1.55	28
2.12	1.50	27
3	1.31	19
4	1.22	14
5	1.16	11

A comparison with the table for two lamps shows at once the superiority of the four lamps equipment. The lamps need not be put so far apart, and they are closer to the board, thus giving stronger illumination. For instance, when the distance from the lens to the board is twice the width of the original ($\frac{u}{p}=2$), the separation of the two lamps of a pair (side of the square) is only 1·55 times the width of the original, while it is 1·74 times the width with two lamps. The four lamps are at a distance 1·1 P from the board against 1·5 P for two lamps. Another advantage is that it is sufficient to place the four lamps beyond the range of reflexion for the shortest dimension of the original, while the two lamps must be beyond the range for the greatest dimension.

Limiting again the separation of the two lamps of a pair to one and a half times the width of the original, the focal length required is deduced as before:

$$f=2.12p\frac{u}{u+1} \qquad (10)$$

The largest plate of the camera of the Surveyor General's office is 24″ × 32″. The lens was selected and the lamps disposed for a reduction of 2·00. The original which, reduced twice, fills the plate must be 48″ × 64″; no larger originals are handled in the office. The lamps are placed above and below the range of reflexion, that is to say the height of the plate, 24″ is taken for p in (10). The formula gives:

$$f=33''.9$$

The focal length of the lens actually used is 33·7 inches (856·4 mm.); it is employed for enlargements and for reductions up to 2·45 when the plate carriage is at the extreme end of the cradle.

For the reduction of 2.00, the original being 48 inches high, the normal disposition of the lamps would be a square of 72 inches side (one and a half times 48 inches), and their distance from the board seven--tenths of 72 inches or 50 inches. They have, however, been placed a little closer to the board and form a smaller square so as to give more light to the margin of the board than to the centre. According to the explanation given, there can be no reflexion up to a reduction of 2·00, nor can there be any between 2·00 and 2·45, because the image no longer fills the plate.

Very little work requires a reduction of more than 2·45. For such work a lens of 18″·6 focus (472·9 mm.) is provided; its range extends from 2·45 to 6·65, in connection with small plates, the image being always small with such large reductions. This small lens is also used on the reverse camera, which is for work of comparatively small size. Its range there is from an enlargement of 1·20 to a reduction of 5·80.

PART III

TABLE

PART III.—TABLE OF FACTORS FOR COMPUTING THE GRADUATION OF A COPYING CAMERA AND OF COMPARATIVE EXPOSURES.

Reduction or Enlargement n	Lens Conjugate $1 + \frac{1}{n}$	Plate Conjugate $2 + n + \frac{1}{n}$	Comparative Lens Openings	Comparative Exposures	Reduction or Enlargement n	Lens Conjugate $\frac{1}{1+n}$	Plate Conjugate $(1+n)^2 \div (2+\frac{1}{n})$	Comparative Lens Openings	Comparative Exposures
1.00	2.00000	1.00000	4.0	4.0	3.25	1.30769	5.55769	18.1	1.7
.05	1.95238	.00238	.2	3.8	.30	.30303	.60303	.5	
.10	.90909	.00909	.4	.6	.35	.29850	.64850	18.9	
.15	.86956	.01956	.6	.4	.40	.29411	.69411	19.1	
.20	.83333	.03333	.8	.3	.45	.28985	.73985	.8	1.6
.25	.80000	.05000	5.0	.2	.50	.28571	.78571	20.2	
.30	.76923	.06923	.3	.1	.55	.28169	.83169	.7	
.35	.74074	.09074	.5	.0	.60	.27777	.87777	21.2	
.40	.71428	.11428	.7	2.9	.65	.27397	.92397	.6	
.45	.68965	.13965	6.0	.8	.70	.27027	.97027	22.1	
.50	.66666	.16666	.2	.7	.75	.26666	6.01666	.6	
.55	.64516	.19516	.5	.6	.80	.26315	.06315	23.0	
.60	.62500	.22500	.7	.6	.85	.25974	.10974	.5	
.65	.60606	.25606	7.0	.5	.90	.25641	.15641	24.0	
.70	.58823	.28823	.2	.4	.95	.25316	.20316	.5	
.75	.57142	.32142	.5	.4	4.00	.25000	.25000	25.0	
.80	.55555	.35555	.8	.4	.05	.24691	.29691	.5	1.5
.85	.54054	.39054	8.1	.3	.10	.24390	.34390	26.0	
.90	.52631	.42631	.4	.3	.15	.24096	.39096	.5	
.95	.51282	.46282	.7	.2	.20	.23809	.43809	27.0	
2.00	.50000	.50000	9.0	.2	.25	.23529	.18529	.6	
.05	.48780	.53780	.3	.2	.30	.23255	.53255	28.1	
.10	.47619	.57619	.6	.2	.35	.22988	.57988	.6	
.15	.46511	.61511	.9	.1	.40	.22727	.62727	29.2	
.20	.45454	.65454	10.2	.1	.45	.22471	.67171	.7	
.25	.44444	.69444	.6	.1	.50	.22222	.72222	30.2	
.30	.43478	.73478	.9	.0	.55	.21978	.76978	.8	
.35	.42553	.77553	11.2	.0	.60	.21739	.81739	31.4	
.40	.41666	.81666	.6	.0	.65	.21505	.86505	.9	
.45	.40816	.85816	.9	.0	.70	.21276	.91276	32.5	
.50	.40000	.90000	12.2	.0	.75	.21052	.96052	33.1	
.55	.39215	.94215	.6	1.9	.80	.20833	7.00833	.6	1.4
.60	.38461	.98461	.9	.9	.85	.20618	.05618	34.2	
.65	.37735	5.02735	13.3	.9	.90	.20408	.10408	.8	
.70	.37037	.07037	.7	.9	.95	.20202	.15202	35.4	
.75	.36363	.11363	14.1	.8	5.00	.20000	.20000	36.0	
.80	.35714	.15714	.4	.8	.05	.19801	.24801	.6	
.85	.35087	.20087	.8	.8	.10	.19607	.29607	37.2	
.90	.34482	.24482	15.2	.8	.15	.19417	.34417	.8	
.95	.33898	.28898	.6	.8	.20	.19230	.39230	38.4	
3.00	.33333	.33333	16.0	.8	.25	.19047	.44047	39.1	
.05	.32786	.37786	.3	.7	.30	.18867	.48867	.7	
.10	.32258	.42258	.7	.7	.35	.18691	.53691	40.3	
.15	.31746	.46746	17.2	.7	.40	.18518	.58518	41.0	
.20	.31250	.51250	.6	.7	.45	.18348	.63348	.6	

FACTORS FOR COMPUTING GRADUATION OF COPYING CAMERA AND COMPARATIVE EXPOSURES.

Reduction or Enlargement	Lens Carriage	Plate Carriage	Comparative Exposures		Reduction or Enlargement	Lens Carriage	Plate Carriage	Comparative Exposures.	
			Enlarging	Reducing				Enlarging	Reducing
n	$1+\frac{1}{n}$	$2+n+\frac{1}{n}$	$(1+n)^2$	$(1+\frac{1}{n})^2$	n	$1+\frac{1}{n}$	$2+n+\frac{1}{n}$	$(1+n)^2$	$(1+\frac{1}{n})^2$
5.50	1.18181	7.68181	42.2	1.4	7.75	1.12903	9.87903	76.	1.2
.55	.18018	.73018	.9		.80	.12820	.92820	77.	
.60	.17857	.77857	43.6		.85	.12738	.97738	78.	
.65	.17699	.82699	44.2		.90	.12658	10.02658	79.	
.70	.17543	.87543	.9		.95	.12578	.07578	80.	
.75	.17391	.92391	45.6		8.00	.12500	.12500	81.	
.80	.17241	.97241	46.2		.05	.12422	.17422	81.	
.85	.17094	8.02094	.9		.10	.12345	.22345	82.	
.90	.16949	.06949	47.6	1.3	.15	.12269	.27269	83.	
.95	.16806	.11806	48.3		.20	.12195	.32195	84.	
6.00	.16666	.16666	49.0		.25	.12121	.37121	85.	
.05	.16528	.21528	.7		.30	.12048	.42048	86.	
.10	.16393	.26393	50.4		.35	.11976	.46976	87.	
.15	.16260	.31260	51.1		.40	.11904	.51904	88.	
.20	.16129	.36129	.8		45	.11834	.56834	89.	
.25	.16000	.41000	52.6		.50	.11764	.61764	90.	
.30	.15873	.45873	53.3		.55	.11695	.66695	91.	
.35	.15748	.50748	54.0		.60	.11627	.71627	92.	
.40	.15625	.55625	.8		.65	.11560	.76560	93	
.45	.15503	.60503	55.5		.70	.11494	.81494	94.	
.50	.15384	.65384	56.2		.75	.11428	.86428	95.	
.55	.15267	.70267	57.0		.80	.11363	.91363	96.	
.60	.15151	.75151	.8		.85	.11299	.96299	97.	
.65	.15037	.80037	58.5		.90	.11235	11.01235	98.	
.70	.14925	.84925	59.3		.95	.11173	.06173	99.	
.75	.14814	.89814	60.1		9.00	.11111	.11111	100.	
.80	.14705	.94705	.8		.05	.11049	.16049	101.	
.85	.14598	.99598	61.6		.10	.10989	.20989	102.	
.90	.14492	9.04492	62.4		.15	.10928	.25928	103	
.95	.14388	.09388	63.2		.20	.10869	.30869	104.	
7.00	.14285	.14285	64.0		.25	.10810	.35810	105.	
.05	.14184	.19184	.8		.30	.10752	.40752	106	
.10	.14084	.24084	65.6		.35	.10695	.45695	107.	
.15	.13986	.28986	66.4		.40	.10638	.50638	108	
.20	.13888	.33888	67.2		.45	.10582	.55582	109.	
.25	.13793	.38973	68.1		.50	.10526	.60526	110.	
.30	.13698	.43698	.9		.55	.10471	.65471	111.	
.35	.13605	.48605	69.7		.60	.10416	.70416	112.	
.40	.13513	.53513	70.6		.65	.10362	.75362	113.	
.45	.13422	.58422	71.4		.70	.10309	.80309	114.	
.50	.13333	.63333	72.2		.75	.10256	.85256	115.	
.55	.13245	.68245	73.1		.80	.10204	.90204	117.	
.60	.13157	.73157	74.0		.85	.10152	.95152	118.	
.65	.13071	.78071	.8		.90	.10101	12.00101	119.	
.70	.12987	.82987	75.7	1.2	.95	.10050	.05050	120.	